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NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

THE DEVELOPMENT OF THE ADMINISTRATIVE SCIENCES
PERSONAL COMPUTER NETWORK TUTORIAL

by

Gloria Denise Dyer

September 1987

Thesis Advisor:

N. F. Schneidewind

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The Development of the Administrative Sciences
Personal Computer Network Tutorial

by

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Submitted in partial fulfillment of the
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ABSTRACT

The preparation of software documentation is an iterative process that involves research, analysis, design and testing. The author must possess a solid comprehension of the technical aspects of the document he or she is preparing, good writing skills and most important, an understanding of the needs of the audience for whom the document is written.

This thesis chronicles the course of events involved in developing a tutorial for a computer network system. The final product is a prototype of a tutorial that reflects the comments and recommendations offered by users during the tutorial usability tests.

Thesis
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I. INTRODUCTION

There is little doubt in anyone's mind that the impact of the computer age has affected us all. We are being flooded with new complex computer systems in which acquiring and retaining information has become increasingly difficult. The technological innovations in the computer field has created problems for both system designers and educators. System designers are faced with the dilemma of trying to create user friendly interfaces for these new systems, while educators must find ways of teaching complicated information to potential users.

The materialization of these problems has led to much attention being paid recently to the field of user interface design. No longer is it important to just design systems that meet the market demand, but systems must be designed and presented so that it is alluring to the user. As such, the human factors issue plays an enormous role in the design of new computer systems.

Along with the emergence of new systems, software that takes advantage of advanced technology must also be written and documented. When carefully developed, documentation can be used as a supplemental effort to ease the transition and enhance the relationship between user and machine [Schneiderman, 1986, p.358].

Another contributor to the dilemma created by new computer production, is the system comprehension issue. As hardware becomes more complex, technical manuals have become increasingly voluminous to be able to accommodate pertinent facts. While enormous amounts of this information becomes available, more efficient ways of absorbing its content must be developed. Newly developed teaching aids must now encompass the

technical sophistication of computer systems in addition to addressing the human-computer interface issues [Bradford, 1983, p.131]. Also, training must address a more diverse audience that is not only made up of data processing professionals but also clerical workers and managers. One way to meet these disparate needs is to utilize tutorials and incorporate them into the learning process.

A. PROBLEM BACKGROUND AND DEFINITION

The 1980s have become the age of the microcomputer. As microcomputers continue to grow in numbers and utilization, so does the need for communication between them. Spurred by the need to share hardware, software and data, local area networks (LANs) are expected to proliferate in this environment [Sachs, 1985, p.108].

Many offices are now sharing their computer resources through networks, but even in small non-networked office environments, the potential for sharing computer resources is present and the move towards distributed systems is inevitable. This prediction is based on the assumption that most personal computers do not operate in offices alone. Programs and data in offices are commonly shared among machines and users via the exchanging of disks. Normally as an organization grows, so does its need for more powerful computers, larger storage devices, more memory, increased efficiency in the retrieval and update of data and more sophisticated peripheral devices [Luhn, 1985, p.72]. For organizations who want to cut costs, one solution is to share their equipment [Derfler, 1986, p.141]. This cost cutting objective can be achieved through the use of computer networks.

Networks represent a new concept in computing. They offer an effective, efficient way to share data [Sachs,

1985, p.108]. However, users need to understand and be aware of the properties of networks before they can operate in this type environment. To meet these demands, adequate training must be made available. Network training should be directed towards the student, clerical worker, managers and others who will use computers in their future careers. Unfortunately, these new target audiences have varied levels of computer knowledge and experience, and often possess conflicting goals and expectations. This thesis is concerned with the issues involved with training one of these audiences, the management student, in the operations of computer networks.

1. Problem Definition

It is not sufficient to only train management students in the system's operation. These students are the future decision makers, and hence their jobs will entail in part, making determinations as to whether computer systems will be installed in their workplace. They therefore need additional exposure to the system.

Information must be provided to management students in the managerial, functional and technical areas. They must attain a comprehensive view of the equipment necessary to make implementation possible. That is, they need to know something about the hardware and software necessary to install a computer network system. Without this additional information our future decision makers are not able to understand the systems for which they must make intelligent decisions. By learning how the network operates, the management students will be better qualified to make decisions in their future jobs.

Often tutorials are developed without regard for the audiences' needs. Not all users have the same

learning needs or desires, so learning must be tailored to meet the requirements of the users. An analysis of this issue must be done early in the document's development so information is available before the documentation design begins.

This thesis analyzes the functional and design issues associated with the development of a tutorial for management students of the Naval Postgraduate School, and produces, through an evolutionary process, a tutorial as an end-product of this study. The study is a report of the developmental process used to design a tutorial for the Administrative Science Personal Computer Laboratory (PC Lab) Local Area Network (LAN) System.

B. THE TUTORIAL PROJECT

In 1986, a plan to develop and install a microcomputer network laboratory for use by the students and faculty of the Administrative Sciences Department of the Naval Postgraduate School (NPS), Monterey, California was put into effect. In March of 1987, the network was opened for departmental usage.

The network administrators decided that learning and educational material should be provided to assist the users in operating the LAN. Start up instructions were posted on the walls to log the user onto the system, and once in the network environment, assistance was available in the form of online help menus. In addition, formal documentation prepared by the manufacturer (IBM) was available through the administrators upon request by persons desiring more information on the network.

During the implementation of the network, concern was expressed that the network users may need a more formalized method of learning the system. The

manufacturer's user manuals were long and complex, and provided more than enough information needed to introduce new students to the laboratory. In addition, most of the courses which utilized the network focused primarily on learning the particular applications pertinent to that course. The courses which did teach the network system, are not taken by the administrative science student for whom this network was installed. It was then decided that a teaching aid was needed that would quickly introduce the user to the common technical terminology and operation of the system without having to wade through a technical manual for instructions.

The determination was made to create the learning aids in-house, using thesis students to develop them. Tutorials were decided upon since they were easy to use, cost efficient to develop and did not require instructors or a classroom setting. There would be two introductory network tutorials. One would be designed for the new computer user to introduce him to the basic computer terminology and present a general overall picture of the network options available. The other tutorial would provide a more in depth look at the most common network operations and associated software and hardware. This tutorial would be directed toward the new network user who already possesses a basic understanding of computer operations and language or had previously viewed the introductory tutorial. This thesis represents the latter learning system and details the efforts applied to the development and design of the Administrative Sciences PC Network Tutorial in Appendix B.

C. PURPOSE

The purpose of this study was to produce a product capable of introducing new users of a computer network to the concepts and operations of the IBM Local Area Network.

The significance of this project was major. Not only would an end product evolve to be of actual use to students, but information would be acquired throughout the process that would demonstrate under what conditions students learn and accept their introduction to unfamiliar computer systems. The analysis sought to examine the different reactions of tutorial users during a controlled test to determine what elements comprise an effective teaching aid.

D. OBJECTIVES

The primary objective of this project was to develop a tutorial which would be used and understood by users of the Administrative Sciences PC Laboratory. This objective was divided into two areas: System Objectives and Design Objectives.

System Objectives:

- To improve the quality of documentation available to network users by creating a tutorial based on the functional and educational need of the users.
- To help combat negative attitudes that often occur when people are introduced to computers, by designing a user friendly interface to convey network fundamentals.
- To promote student interest in computer networks by describing a clear picture of the system operations and how it can help in the performance of their future jobs.

- To develop a tutorial that trains the average user how to use the network in less than 4 hours.
- To provide a hard copy reference that students can refer to.

Design Objectives:

- To reduce network confusion by effectively communicating the concepts of network operations in easy to understand terminology.
- To identify the most frequently used functions of the system and incorporate them into the tutorial.
- To design a guide that is easy to read and in which information can be located effortlessly.
- To effectively capture the human-computer interface dialogue and present that information in a way that is easy to understand and use.

E. SCOPE - DISCUSSION OF OBJECTIONS

The problems designing a tutorial are many. These problems are the variables upon which this paper focuses. The intent of this study was to investigate the variables needed to produce an effectual tutorial. These variables were tested to determine their effectiveness, and modifications then made based on users needs and recommendations.

The variable with the greatest predictive power was audience assessment. Tutorial design provided the next most effective means of predicting successful documentation.

1. Audience Description

This tutorial was designed to address an audience that represents an older than average college graduate student. Most of these students have been trained in some technical or managerial area in which they have been working for a number of years. Most will be pursuing advanced degrees in the administrative

/ managerial science area, and have limited amounts of free time available due to the constraints that course requirements place on them. Computer familiarity varies immensely with experience ranges from the complete novice to the computer hacker.

2. Design Issues

Although knowing the audience you are addressing is important, it is also vital to know how to organize and instruct technical information. The most frequent complaints of computer manuals are:

- Poorly written manuals. Computer manuals are often written by technicians who have no conception of how to present information to users without using technical jargon. The end product is a manual that is of inferior quality and difficult to understand.
- Important information is hard to find. Computer guides that are not organized around user tasks are often confusing. Users have to expend extra time and effort deciphering the layout scheme.

Considering the issues involved, to be effective, a tutorial developed for NPS users should be task oriented and written in layman's terms.

3. Limitations of the Study

The limitations of this study were primarily reflected in the technical knowledge of the author. As a computer systems management student who lacked the advanced programming skills to develop an effective tutorial that utilized computer aided instruction, it was decided early in the research to concentrate on a hardcopy end product.

F. PLAN OF DEVELOPMENT

The focus that a project eventually takes is reflected in its developmental process. A well

developed tutorial is not only an effective learning tool, but can easily speed up the learning process. Utilizing a structured approach to tutorial design, not only aids the creator in organizing the tutorial, but is also the primary determinant to producing a well developed and useful guide.

The procedures used to develop the Administrative Sciences PC Network Tutorial was based on a 7 step user guide test developed by Victoria M. Winkler, Richard Ferguson, and Diane Younquest in 1985 at the University of Minnesota. Modified to fit this project, the procedure used was a combination of this methodology and a quasi-prototype approach:

1. Identify the project scope and objectives.
2. Review resource material.
3. Develop a preliminary task list.
4. Observe users performing the tasks.
5. Develop a prototype of the tutorial.
6. Test the tutorial usability record problems.
7. Revise the tutorial and retest.

G. CONTENT

The first part of the project is reflected in the introduction. The problem definition, objective, scope, and limitations of the study are identified here. A review of research materials relating to the history, goals and types of tutorials are included in chapter two. Chapter three contains information on the analysis and design issues that were considered in the development of the tutorial, and a plan outlining the administration of a usability test is provided in chapter four. The last two chapters are the analysis of the usability test results and how these results impacted the tutorial development. In addition, the

conclusions that were determined as a result of the study are presented in chapter six.

Although not specifically stated throughout this thesis, the research of resource materials was not only conducted during the analysis phase, but was ongoing throughout the test periods. The ongoing research was downplayed, since the significance of this paper is determined by the issues associated with tutorial development and not the functional specifications of the system. As such, the emphasis of the remaining thesis chapters is on tutorial design, analysis and testing.

H. CONCLUSION

Although the end product of this study is only a prototype, its usefulness is reflected in the favorable comments by the students tested. The tutorial was designed and written in an iterative manner in which feedback from users was incorporated and the tutorial modified. The project's relevance lies in the assumptions that the tutorial usability test revealed. The usability test findings showed the tutorial had an increased value to the users as the study progressed and their feedback was incorporated into the product. Comments from test participants indicated, that significantly less changes needed to be made to the tutorial as the project progressed.

II. LITERATURE REVIEW OF TUTORIALS

A. HISTORY OF TUTORIALS

The idea of utilizing tutorials as a form of programmed instruction was first introduced by S. L. Pressey in the 1920s and 1930s. At this time programmed instruction was seen as a way to free teachers from the tedium of drill and practice sessions. Students were provided with instructional material to read and then given applicable multiple choice questions to answer that related to the reading material. Based on the results of the quiz, teachers then decided whether the student could proceed to the next section. [Rubens, 1986, p.17]

Unfortunately, programmed instruction did not catch on in the 1930s. In 1954 however, behavioral psychologist, B. F. Skinner, developed Pressey's idea. Skinner differed from Pressey in that he thought students should be presented with short passages of instructional information, then afforded the opportunity to write out a response rather than choose an answer from a list of alternatives. In this way students responded only to what they actually learned. This was called the small step approach. The small step approach could be used to shape behavior by frequent reinforcement which would ultimately result in learning. [Rubens, 1986, p.17]

After the introduction of the computer, computer assisted instruction (CAI) replaced the old form of programmed instruction. Since multiple choice answers were easier to program than open ended responses, the mechanics and restrictions of a computer made it better suited for Pressey's style of programmed instruction.

Unfortunately, programmed instruction was not fully developed before the arrival of the computer. After the computer's emergence, attention was directed toward learning the computer rather than developing improved instructional methods. Attention turned from the development of the instructional research to a preoccupation with the computer and how it is used. [Rubens, 1986, p.17]

Tutorials are actually a type of programmed instruction. They serve to familiarize users with new programs or systems and teach fundamental operations [Bradford, 1983, p.131] by initially providing users with a conceptual overview of the system before trying to explain its component parts. Most systems have more capabilities than the typical new user needs to perform basic operations. A tutorial should not attempt to cover all operations of a system, but rather provide users with "survival information" or the basics needed to get the system up and running in a minimum amount of time. After the user masters these rudiments he can then proceed to the other types of documentation such as reference and technical manuals at a later time when more advanced information is needed. [Bradford, 1983, p.131]

B. TUTORIAL GOALS

The goals of the tutorial are two fold: to entertain and to educate [Bradford, 1986, p.131]. The tutorial should provide users with a positive first time experience so that after completion of the tutorial, the user will want to use the new system again. If the tutorial is entertaining, it is more likely that the user will have a successful experience. However, to be effective the tutorial must also teach.

The tutorial will meet this objective if the user knows more about the system when he completes the tutorial, than he did before he began.

Tutorials are usually presented in a variety of forms ranging from those that emphasize entertaining the users to those that concentrate on objectives and goals. An effective tutorial will fall somewhere in between these emphasis areas.

C. TYPES OF TUTORIALS

The tutorials available for computer products today usually fall in one of four general categories:

1. multi-media tutorials
2. booklet-canned file tutorials
3. book tutorials
4. on-line tutorials

These types are summarized below: [Bradford, 1983, pp. 131-133]

Type	Purpose	Format	Audience
Multi Media Tutorials	to teach a system or application	cassette, book, or disk	clerical
Booklet / Canned Tutorials	survey a system's capability	booklet and disk with manual	professional
Book Tutorials	to teach a system indepth	book	mixed
On-Line Tutorials	to teach a range of skills	disk	mixed

Figure 1 - Types of Tutorials

III. FUNCTIONAL ANALYSIS AND DESIGN

Two methodologies were considered for the tutorial design: on-line and printed tutorials. The characteristics of each are discussed below.

A. COMPARISON OF PRINT AND SCREEN DESIGN

The technology of printing text on paper has been around for more than 500 years. In those years the paper surface, color, font design, margin size and spacing have all been evaluated to determine which produces the most appealing format. [Schneiderman, 1986, p.359]

Printed tutorials are a form of programmed instruction designed to teach at the user's own pace. The words are written and presented in a hardcopy format that is familiar to the user. These paper tutorials are usually faster to learn since they do not require the user to learn additional commands. Also, information can easily be referred back to and cross referenced if the user is unsure about something. In addition, areas that are familiar to the user can be scanned effortlessly. This medium is a good method of tutorial development since it helps make the user feel confident that he knows the information in one section before he proceeds to the next.

On-line tutorials are also a type of programmed instruction, but utilizes the computer monitor rather than paper products to display information. On-line tutorials have recently emerged in the last 30 years as an alternate medium for presenting text. This is an attractive form of instruction since information is

available whenever the computer is on, and graphics and animation can be exhibited. Also, users find learning on a computer more fun and exciting than learning from a book. [Price, 1984, p.100]

The initial costs to produce this type of documentation varies with the degree of sophistication of the tutorial, but they are generally much less expensive to maintain than paper documentation. The disadvantage to on-line tutorials is that visual fatigue occurs at a much faster rate when viewing information on a screen than with printed materials [Schneiderman, 1986, p.359]. In addition, the images seen by the users are not permanent and require users to remember information in order to use it [Krull, 1986, p.23]. Another drawback is the use of command language. The command language may confuse the novice user [Schneiderman, 1986, p.357] since it requires another aspect to learn in addition to the system being taught. There is also a limit to how much information can be displayed on each screen [Price, 1984, p.101]. These delimiting factors may cause an interruption in the flow of information and effect user comprehension.

Research on documentation content has shown that on-line information can be used as an effective form of instruction when good design techniques are used [Krull, 1986, p.23]. Since this type of computer aided design requires advanced technical computer skills that were not available to the tutorial author, it was decided that a printed tutorial should be designed. The principle advantage to a printed text design of the LAN tutorial, is that it could be developed to meet the audience needs given the knowledge base of the author and time constraints of the study.

B. AUDIENCE ANALYSIS

The audience is normally the driving force behind the design of documentation. It is important to analyze the target audience in some detail before preparing documentation since the goal of a tutorial is to communicate knowledge and information in a way that will be understandable and memorable.

The first considerations are, the focus of the guide and how much users know about the system. A mosaic picture must be drawn up to define the audience. Questions such as these must be answered before a picture can be completed:

- What kind of people are the users?
- How old are they?
- What level of educational do they possess?
- Do they have any computer experience?
- Is the audience interested in the subject matter?
- Is the information to be presented relevant to their needs?

A composite picture of the target audience based on these indicators is described in the introduction.

After the audience is defined, a way must be devised to somehow link the target audience to the information that is being presented. The author should prepare information guidelines of how users may react to the guide. Audiences usually fall within two continua, friendly to unfriendly and knowledgeable to unknowledgable. The friendliness continuum has the following variable range: friendly; neutral; disinterested; hostile. The knowledgeable continuum has the following variables: knowledgeable; little knowledge but eager to learn; neutral to learning; resistant to learning. Combining these audience

variables produce a grid of 16 possible audience types. Consideration must be given as to what mode of presentation will be taken when addressing an audience composed of variables from one of the audience types. Figure 2 lists such a tactical plan which was considered before beginning the tutorial design. [Hodgetts, 1986, pp.68-69]

	1. FRIENDLY	2. NEUTRAL	3. DISINTEREST	4. HOSTILE
RESISTANT TO LEARNING	show personal profit	need dramatic start	stress benefits of tutorial	emphasize importance to audience
NEUTRAL TO LEARNING	get audience involved	get audience attention (use humor)	get audience attention fast	concentrate on benefits of learning
LITTLE KNOWLEDGE BUT EAGER TO LEARN	pedagogy important	give facts quick	give audience facts; don't make friends	emphasize education
KNOWLEDG- ABLE	straight forward	refer first to audiences' expertise	find a point to grab their interest	try to diffuse the source of hostility

Figure 2 - The Audience Analysis Grid

The important aspect of the grid is the realization that what may work with one group may be a complete failure with another.

C. DESIGN ISSUES

Normally the first exposure that a new user will have to a system is through a users manual. Careful

planning must be devoted to the design of documentation, since inadequate design results in end-user dissatisfaction.

In designing the network tutorial for the NPS LAN, two types of design issues were considered, external and internal design. External design relates to the access method and the flow of the information presented. These issues are addressed in the organization and content of the tutorial. The internal design focuses on the layout and the actual presentation of the information. In this area, the appearance and language of the tutorial are the elements to be addressed. It is thought that these elements are the four factors most impact the effectiveness of the software design [Gleason, 1986, p.142].

1. Organization

Before designing a tutorial, the scope of information needed by the user must be designed [Costa, 1986, p.309]. Consideration must be given to what information is essential and how to organize this information. An effective users guide must be organized to coincide with the way users look for information. The organization that is apparent to the user, minimizes the time spent learning how to use the tutorial so more time can be spent learning the system. The best way to accomplished this learning atmosphere is by using a structured format.

The structured format used in this tutorial design is a rhetorical strategy that is actually a combination of two strategies, the "whole to parts" and the "most used to least used" strategies. "Research reports that the users need at least some conceptual information, some "whole" idea, before they have a

context for understanding the parts of that idea." [Bradford, 1983, p.133] The "whole" idea is the instrument used to get the readers attention in the beginning. The audience is draw into the context of the material at this point and the narrator of the system is put on common ground with the users [Gleason, 1983, p.142]. The "parts" can then be presented, introducing the functions of the system in a decreasing order of frequency used.

The length of a tutorial varies depending on the subject matter. On a whole, 20 - 30 minute chunks of information (or single ideas) is the industry guideline [Bradford, 1983, p.133].

Research also indicates that users prefer multiple small tables of contents to one large one. Devices that act as advance organizers, such as descriptive headers, typographical cueing and summaries are usually preferred [Bradford, 1983, p.133].

2. Content

The content is the part of the manual that describes operations. It focuses on commonly used tasks and its productivity is measured in terms of relevancy to the user. Attitudinal variables and general user impressions all play important roles in a tutorial's content.

As stated earlier, one of the goals of the tutorial is to produce a positive first experience for the new system user. Although positive first experiences can not be guaranteed, the composition of a manual can help to achieve this. Only the content that the user needs should be included. The manual should be brief, but not at the sacrifice of pertinent information. In some cases, however, a deviation from the normal flow is necessary to explain a concept.

Regardless, applicable topics should be emphasized. A good way of illustrating the relevancy of a task is by providing practical exercises [Gleason, 1983, pp.143]. The exercises should be short and interspersed systematically through out the tutorial.

3. Appearance

The appearance of a manual reflects the attitude of the author. A manual that is visually appealing and has a good layout indicates a concern for the user reaction. A document that is initially captivating to the user can help him learn the subject matter faster since it puts him in a good frame of mind in the beginning. Consider that some people think visually rather than physically. Often an illustration can convey a relationship that is hard to explain using words.

The elements of design that should be considered are:

- figures, illustrations and diagrams
- headings of several levels: small, medium, large
- key terms: boldfaced or italicized
- lists: butted or numbered
- sample screens
- warnings

The way a guide is packaged makes a strong first impression on users [Price, 1984, pp.104]. The use of white space is particularly attractive in a manual. This not only makes the document easier to read, but gives the document an expensive, generous look.

4. Language

The choice of words and sentence structure is an essential linguistic issue in document design. One of the initial design considerations for this project

was language tone. Tutorials should be user friendly with information presented in a simple, easy to use manner. Researchers emphasize that users of all educational backgrounds prefer simple language when learning a new system, with readability at the eighth grade level [Gleason,1983, p.143]. Clearly written guides produce less complaints, make the system easier to use, reduce the frustration factor, save time and decrease the chances of user errors and misapplication.

VI. THE TUTORIAL TEST PLAN

A. INTRODUCTION

As in the development of any new product, the ultimate test of a product's worth is in the marketplace. If it is accepted there, it has passed the test. The most appropriate time to perform such a test is during the developmental stage of a procedure when there is still a chance to correct any mistakes made. When test personnel are utilized to assess the usefulness of a developing project, the process is called usability testing.

Usability testing was the method chosen to evaluate this project. Through this, the objectives and goals of the tutorial that were established at the project's inception were hoped to be satisfied, although the test was mainly intended to verify that the user's guide accurately reflects what the program truly does.

To be effective, testing must be carefully planned, specifying the responsibilities of both the developer and the user. It is the test plan that is the document used to incorporate all of this information required for the testing. It describes the requirements, the plan of action and evaluation criteria. The test plan also contains the test specifications and details of the step by step testing procedures.

B. TEST PURPOSE

The purpose of usability testing in the preparation of documentation is to determine improvements that can be made to a manual. Testing helps to provide information on how to improve the document before it is

completed. Changes can then be made and the guide retested before the completed version is released.

Usability testing is designed to help find solutions to problems in the manual's wording, flow, and layout. It should indicate whether the writing style used in the manual can be understood by the intended audience. The test can also help identify steps that may have been inadvertently left out or point out descriptions that do not match tasks. In addition to providing information regarding needed structural modifications, the testing can also provide information from test subjects on what areas they would like to see covered in the guide.

C. TEST OBJECTIVES

The main objective is to identify problem areas in the manual while it is still in the development stage. While developers should always strive to detect project deficiencies as early as possible to permit suitable corrective action to be taken, through testing, the merit of a guide is checked while there is still time to correct mistakes. Specifically, it is hoped that through the testing phase, the following problems can be corrected: [Zirinsky, 1986, p.121]

1. Misuse of Terminology

Terminology used should be descriptive of the task or feature it is naming. To do otherwise will cause confusion on the part of the user.

2. Inconsistent Instructions

Instructions should be presented using a clear, logical pattern that is easy to follow.

3. Layout Problems

The tutorial should be designed so that information sought can be easily found. Information should not

be displayed on a page that is cluttered with unnecessary details.

4. Immaterial Content

The documentation should be developed with a specific audience in mind and the materials incorporated should contain items of interest and use to the intended users.

D. TEST REQUIREMENTS

1. Test Content

After carefully reviewing the system documents, learning the network and observing the casual users of the system, a list of questions was developed of the items that were felt to be the most important topics to be concerned with when developing the manual (Appendix A). These topics included items that could cause the users confusion. Also included were layout and organizational issues and technical and operational errors.

2. Test Participants

The test would be primarily conducted using people who resemble the target audience, but two other groups would also be evaluating the tutorial. The principle group would be from the Management 2901 course at NPS. These participants were new incoming NPS students who possessed varying degrees of computer knowledge and experience. Another group would be the resident network experts. This group would consist of faculty members who were involved in some way with the network's implementation and operation. They would view the prototype first to give the manual a technical edit. The purpose of the technical edit was to expose inaccuracies in content, and correct erroneous program statements before the guide was put in front of the group that represents the actual users [Zirinsky, 1986,

p.123]. The third group would be made up of persons experienced in the development of user guides and tutorials. This group would provide the writing edit, offering recommendations as to the general format, structure, punctuation, spelling and grammar of the guide.

3. Test Administrator

The test would be administered and observed by the author. The job of the observer would be to be present during the entire testing time and observe the movement, gestures and facial expressions of the subjects [Zirinsky, 1986, p.123]. In addition to the formal critique and comments that was requested of all participants, watching people as they worked through the tutorial is another way to determine the actual reaction to the manual.

4. Evaluation and Critique

A questionnaire would be distributed to all primary test participants along with the tutorial for them to complete at the end of the test session. The questions were divided into three categories: readability, sequencing and design, with rating scales which followed each question. The participants would select a number that best resemble their feelings concerning that item and express general comments in the space provided at the end of the questionnaire.

5. Logistics

All resources needed for the testing (computers, printers, programs, desks, outlets etc.) would be already set up, with sufficient copies of the test manuals and questionnaires available prior to each session. The location would be in the microcomputer lab where the network was currently in operation. Test dates were established for approximately 150 administrative science students on the following days:

Session I	- Thursday, July 9	1000 - 1200
Session II	- Friday, July 10	1300 - 1500
Session III	- Monday, July 13	1000 - 1200
Session IV	- Thursday, July 16	1000 - 1200
Session V	- Friday, July 17	1300 - 1500
Session VI	- Monday, July 20	1000 - 1200

Times for the other test groups would be subject to their availability.

6. Test Materials

The items associated with the test that would be referred to in the tutorial and be used by participants were:

- the network program
- the application program
- a printer

Students would only be requested to bring in an unformatted, floppy disk.

7. Test Constraints

The most limiting constraint would be the time required to conduct the test. The tutorial was initially designed to be completed within 2 hours but different reading, absorption and performance rates could cause the guide to be completed in more or less time than allocated. Also, the usability tests themselves would have an impact on the lab itself since the network would not be accessible to the general student population during the testing periods.

E. TEST ADMINISTRATION

The major portion of the testing would consist of 6 sessions conducted over six days. There were two hours allowed for each session. At the beginning of each session the administrator would explain the purpose of the usability test, distribute the tutorials and questionnaires and instruct users when to begin.

During the test, careful attention would be paid to unspoken gestures. Questions would be answered when necessary and all interaction taking place would be carefully noted in a logbook. Upon completion of the test all materials distributed would be collected. Users would then be handed another questionnaire, and asked to continue to refer to the tutorial for one week, evaluate the prototype again and return the completed questionnaires to their professor.

F. EXPECTATIONS

The most important concept to be explained to the participants is that the usability test is designed to uncover problems and weaknesses associated with the documentation of the guide. Most of the improvements made to the guide would be the result of users who find problems with the guide. By assuring the participants that their comments would play an important role in determining the final product, it was hoped that constructive feedback would be received that would aid in the development of a better user's manual.

V. TUTORIAL ANALYSIS

The results of the usability tests focused primarily on the tutorial's usefulness and the success and short comings of the tutorial. The primary benefit of the tests were in the improvements to the document. Participants identified the following types of errors:

- typographical errors
- factual mistakes
- inconsistent format
- layout errors

Improvements to the manual was indeed beneficial, however, the most advantageous lessons were learned from the different groups tested.

A. TEST PROCEDURES

The initial test plan stipulated that six formal test sessions would be held. The student participants of these sessions were to be the new Administrative Science students in their first quarter of study who were all enrolled in the NPS course MN 2901. This course was designed to acquaint new administrative science students with microcomputers and popular application programs. After one class meeting students signed up for one of the usability test sessions. Two hours were allotted for each session and all materials required to work through the tutorial was provided for the participants.

From the beginning of the first session, the test administrator noticed that students were having trouble following the tutorial. Elementary computer terms were incomprehensible by the participants, computer keys could not be found (even with a diagram included), and

disks were inserted wrong (one disk was actually destroyed in the process). These initial minor frustrations turned into total anxiety as the test progressed. Pertinent information was skipped that was needed to perform a later operations and the administrator spent the remainder of the session answering angry questions. Finally at the end of two hours all questionnaires were turned in and test materials returned to the administrator. Only 15 out of 24 questionnaires were completed with most indicating that their experience was disappointing.

After the first session, two things were decided. One, was that the test population was wrong and the other, that too many people were tested at the same time.

Using the same manual with no modifications made, several people with a little more computer experience were tested. These people were tested individually rather than in a group. This time the results were more favorable. Users accepted the basic manual as beneficial, however, did provide comments which indicated that improvements could be made to the tutorial's structural content. The manual was modified and then retested on technical and tutorial experts. More comments were supplied and modifications were again made. A total of ten individuals reviewed the manual during this time.

Three weeks after the first test session, a second session was held. This session consisted of eight volunteers. Three were from the administrative science curriculum and five from the information systems management curriculum. All were familiar with microcomputers although the degree of this familiarity varied immensely among participants. The group was

composed of all network novices and the same instructions were given to this group as to the first. The participants took from one hour and 15 minutes to two and one half hours to complete the tutorial. This time all questionnaires were returned completed.

B. RESULTS

The tests helped to refine the design of poorly composed sections of the tutorial. After observing the confusion, poor performance and comments of the first test session, the information was reformatted and presented in a way that was easier to understand. Also, tasks were described in a way that made them simpler to complete.

Testing brought back the initial goal of writing to a specific audience. The test subjects who were familiar with computers had little trouble with the tutorial. They made suggestions to improve the structural format, but on a whole, these testers found the system easy to learn, the experience interesting and thought that the guide would be of great benefit to other students in the school. On the other hand, the students that had not been exposed to computers before became frustrated with the use of terminology they did not understand. This unpleasant experience resulted in exasperation, bitter comments and irrational suggestions. Also, most of these students found that the system was unable to meet their needs.

C. FINDINGS

Although the information gathered as a result of the testing does not signify conclusive results due to the "lack of rigor of the test methodology" [Zirinsky, 1986, p.25], strong evidence can be gathered to

support indications of users learning habits during the introduction of a new computer system. It is these implications that guided the revision of the document design.

The findings support the evidence that users perception and reaction are important elements in the acceptance of a new system. The users tested generally fell into one of the descriptive categories characterize in the audience continuum. The first group participated in the usability test because it was a required assignment. They were disinterested in the subject matter and resistant to learning the materials that were presented. There was also some resentment and hostility since they were required to be there. The knowledge level of the session one students, however, varied too much to pinpoint on the knowledge continuum.

Assessing these variables and applying the corresponding concepts from the resulting audience grid, a new approach was taken in revising the tutorial. Management issues were presented early in the tutorial. Benefits to managers were stressed in terms managers like to hear such as "increased productivity, cost efficiency, and the removal of company or government liability". Technical descriptions were removed unless it was necessary to describe a piece of equipment or concept needed to understand the system's functionality.

The new approach was incorporated in the tutorial and was quickly accepted by the second session participants. Although the second session students fell within the friendly, cooperative and neutral areas on the continuum it was easy to see that the revised tutorial had a wide reaching effect. The current

tutorial presented in Appendix B is only a prototype, but can be used to communicate with users at all levels of the audience grid.

VI. CONCLUSION

In concluding the results of this study, it was found that the author's intention to create a user friendly tutorial was achieved. This conclusion is based on the invaluable comments and suggestions from the usability test participants. The iterative methodology of the project development allowed the evaluation and refinement process to uncover errors and unclear sections. Changes were made that improved the tutorial and helped to make it a viable teaching tool.

The emphasis shifted during the study (particularly in the testing phase) from creating a guide that the author thought was relevant, to creating a guide that revolved around the user tasks. The "right" approach evolved during the course of the whole project after it was realized that successful documentation required an ongoing dialogue between the developer and the users.

The findings demonstrate that further research is needed in the field of documentation preparation and human factors. Understanding and interacting with users, representative of the target audience who will be reading and working with the manual is essential to document preparation. Specific attention should be directed to the tasks users will initially perform.

Much of the difficulty people experience in learning a new computer system can be directly attributable to poor design [Schneiderman, 1986, p.358]. The egocentric style of designers must yield to humility, and designs adjusted to accommodate the users skills, desires, and orientation [Schneiderman, 1986, p.390]. Designers should understand that their

design efforts may not always produce the desired effects for a particular audience, and be flexible enough to accept redesigning a system when necessary. The techniques for producing quality documentation will be of no use unless audience analysis is given high priority.

In conclusion it can be said that the findings noted in this study can be used by all documentation writers to improve their documentation. The benefits gained from the testing of software documentation is provided in a better understanding of user capabilities and in improvements in design strategy. With the goals of the user clearly in focus, the production of higher quality useful document can be achieved. The ultimate result is, however, in the acceptance and use of the tutorial by the people for whom it was designed.

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APPENDIX A

PC NETWORK QUESTIONNAIRE

This appendix contains the questionnaire used
during the usability test.

PC NETWORK QUESTIONNAIRE

THIS QUESTIONNAIRE WAS DEVELOPED AS PART OF A USABILITY TEST OF THE ADMINISTRATIVE SCIENCES PC NETWORK TUTORIAL. IT WAS DESIGNED TO ALLOW USERS, SUCH AS YOURSELF, TO CRITIQUE THE NETWORK TUTORIAL YOU ARE ABOUT TO TAKE. THE RESULTS OF THIS TEST WILL BE EVALUATED AND INCORPORATED IN A USER'S GUIDE THAT IS CURRENTLY BEING DEVELOPED FOR THIS NETWORK.

THE TUTORIAL YOU HAVE BEEN GIVEN IS A PROTOTYPE OF THE ACTUAL USER'S GUIDE THAT WILL BE DESIGNED. YOUR EVALUATION AND COMMENTS WILL HELP TO IDENTIFY PROBLEMS USERS EXPERIENCE WHEN USING THE NETWORK, AND WILL PROVIDE INPUT INTO CONCEPTS THAT SHOULD OR SHOULD NOT BE COVERED IN A BEGINNERS MANUAL.

THE FOLLOWING PAGES CONTAIN QUESTIONS REGARDING SPECIFIC ASPECTS OF THE PC NETWORK USER'S GUIDE. PLEASE COMPLETE THIS QUESTIONNAIRE AFTER YOU HAVE GONE THROUGH THE GUIDE AND THEN RETURN IT TO THE TEST ADMINISTRATOR. INCLUDED AFTER EACH QUESTION ARE RATING SCALES OR COMMENTS SECTIONS. ASSIGN A NUMBER THAT MOST ACCURATELY REFLECT YOUR ASSESSMENT OF THE STATEMENT. COMMENTS ARE SPECIFICALLY REQUESTED FOR THE LAST THREE QUESTIONS. HOWEVER, FEEL FREE TO ADD ANY COMMENTS YOU MAY HAVE REGARDING ANY OF THE QUESTIONS.

USER EVALUATION OF THE PC NETWORK TUTORIAL

For each question, please circle the number that most accurately reflects your impressions of the tutorial.

READABILITY

A. Overall tutorial readability

easy

difficult

1

2

3

4

5

B. Explanation of tasks

clear

confusing

1

2

3

4

5

C. Instructions describing facts

clear

confusing

1

2

3

4

5

D. Instruction terminology

consistent

inconsistent

1

2

3

4

5

E. Warnings and Tips

beneficial

misleading

1

2

3

4

5

F. Explanation of error correction

clear

confusing

1

2

3

4

5

SEQUENCING

A. Instructions progress in a logical sequence

always

never

1

2

3

4

5

B. Instruction steps are described consistently

always

never

1

2

3

4

5

C. Instructions for correcting errors

appropriately placed

misplaced

1

2

3

4

5

D. Style of instruction is consistent

always

never

1

2

3

4

5

E. Appropriate information feedback given

always

never

1

2

3

4

5

DESIGN AND LAYOUT

A. Focus on user task

always

never

1

2

3

4

5

B. Illustration of concepts

clear

confusing

1

2

3

4

5

C. Simplification of tasks through display layouts

always

never

1

2

3

4

5

* Please answer 1,2,or 3 to the following three questions *

D. Length of tutorial

1 too long

2 enough

3 too short

E. Size of modules describing each task

too large
1

fine
2

too small
3

F. Amount of detail

too much
1

OK
2

too little
3

GENERAL

A. Learning the Network

easy

difficult

1

2

3

4

5

B. Computer experience

novice

1

beginner

2

occasional user

3

frequent user

4

C. Overall reaction

satisfying

1

2

frustrating

3

interesting

1

2

uninteresting

3

Please add your written comments to the following items:

1. What additional areas would you like to see covered?

2. What areas do you think should be explored further? Why?

3. What benefits or improvements would this system provide to your education at NPS?

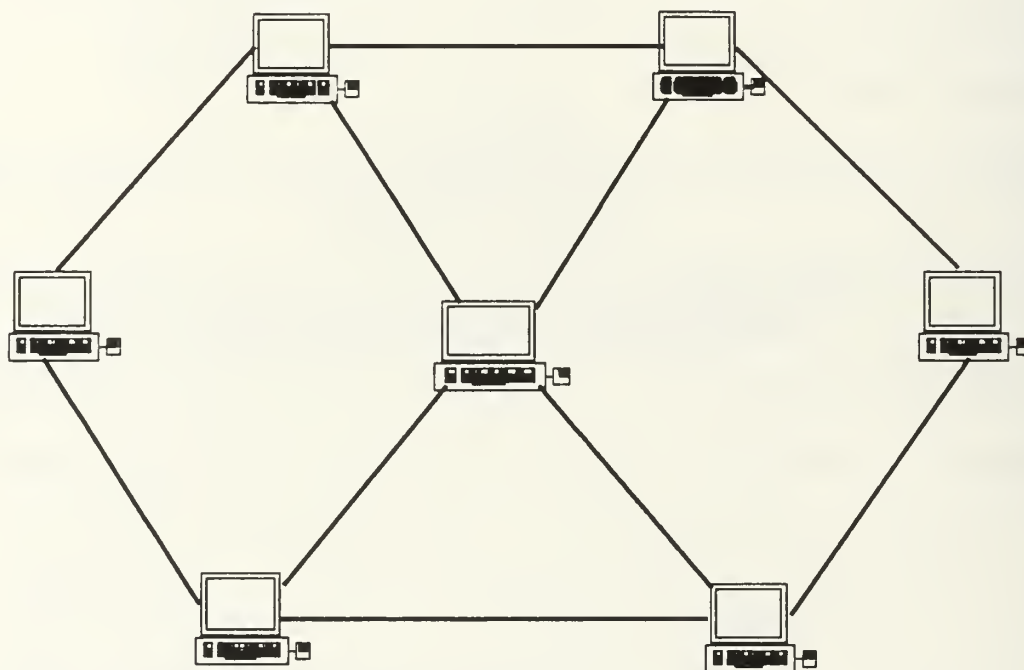
APPENDIX B

NETWORK TUTORIAL

This appendix contains the tutorial
developed during this study.

*THE ADMINISTRATIVE SCIENCES
PERSONAL COMPUTER*

NETWORK



TUTORIAL

SEPTEMBER
1987

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WELCOME TO COMPUTER NETWORKING!

Welcome to the exciting field of computer networking! This rapidly growing field will allow you to perform tasks on a small microcomputer that you thought could only be done on the larger more powerful computers. With computer networks you will be able to use resources and programs that are not directly attached to your machine. Not only will you improve your understanding of computer applications but your knowledge of computer terminology will increase as you use the network. Best of all, most of the materials you will need to start working are already provided for you.

In addition to introducing you to some of the fundamental concepts of a computer network, we will also describe some of the capabilities of the network system. We will use the interactive approach to introduce you to computing. That is, you will learn the system by interacting with the computer.

An abundance of resources and services await you as you enter the network environment. The network is not difficult to learn, but you will have to practice before you become proficient in it's use. We think you will enjoy working on the network. So without further delay, we wish you luck and **happy networking!**

1. INTRODUCING THE COMPUTER NETWORK

In this chapter you will be given a brief overview of computer networks, what they are used for and the benefits they provide. You will also be provided you with information on what tasks you can do on the network, the tutorial setup and how to use it.

In this chapter you will find the following information:

- Why do we need Computer Networks
- What is needed to get started on the network
- How you can use the tutorial

NETWORKS: **WHY DO WE NEED THEM?**

Who needs to learn how to use the Network?

Anyone who will be working with the system should be trained how to use the network.

Why should you learn how to use the Network when you can just as easily use a stand-alone computer?

This network was implemented to provide students studying Administrative/ Managerial Sciences at the Naval Postgraduate School with a place to work on the computer applications most used by the students. Since many of the students will be assigned to management positions upon completion of their studies here, working on the network provides a means to facilitate their learning and understanding of computer networks.

As managers we will need to be aware of new technological advances that affect our workplace. We need to be knowledgeable about these technologies so we can make intelligent decisions regarding their use and implementation. Networks are a new technology that is fast becoming an integral part of office automation and information processing. With microcomputers now firmly established and accepted in our offices as an important part of office automation, the next logical step is to make decisions that allow us to get the most out of these resources. In other words, we must be able to provide information processing at the least cost to our organizations while still providing the maximum functionality. Sharing our resources is one way to achieve this. If there are a number of computers that need to share information, hardware or software with other users, then networking is the cost efficient solution.

The way in which we share our computers' resources is by connecting them together via a communications link so that they may share information and peripheral devices. It will be up to us, as managers, to decide whether a network should or should not be included in our organizations.

This tutorial is intended to help students become familiar with this growing field. By familiarizing users with the basic concepts, vocabulary and components associated with a network, it is hoped that they are able to make more informed decisions in the workplace.

Who benefits most from a Network?

Networks actually benefit both users and managers.

BENEFITS TO USERS

- Multi-user Databases can be accessed. Users with common interests will find working easier when they can exchange files and access common databases.
- Networks provide users with the ability to share and exchange on-line information. Even while working on another application in the network environment you may suspend your operation, send (or receive) a message then return to your application resuming your same place.
- Users will not be limited to using their own computer resources. They will be able to use the larger , more expensive devices such as laser printers and hard disks that are available within the company without leaving their own desks.
- Users with smaller computers can gain some of the power of larger ones. Not only can you share external devices, but you can also use another machine's disk space. With more disk space you are able to access more files.

BENEFITS TO MANAGEMENT

- Productivity will increase. Through the use of collaborative efforts by the users, higher quality work will be output and a more productive work environment will emerge.
- The functional role of a manager can increase. Access to multiple information sources will broaden management's functional role. Managers will be able to receive crucial information immediately and make better decisions since they will have access to a more comprehensive view of the situation.
- By allowing resources to be shared, the overall cost of computing will be reduced. Costly equipment can be centrally accessed by users thus sparing management the expense of purchasing individual equipment.

Benefits to management (cont.)

- Inventory control of software is simplified. Since master programs are installed and maintained centrally, individual copies do not have to be accounted for. The distribution of software is curtailed and users are free from the responsibility of maintaining their own individual copies.

- The company is protected from the liability associated with pirated software. The illegal copying of software is a big problem in offices, and the company's liability for this is a big concern for managers. Although signs prohibiting this activity are visibly posted, the problem still persists. Networking allows organizations to obtain specially designed software with on-site licensing that allows multiple users to work legally with the copyrighted software.

What will you be able to do on this network?

The IBM PC Network will allow you to use programs such as **D-Base III Plus, Lotus 1,2,3 and WordPerfect**. You will be able to access these programs through one of the four computers designated as **servers** (these computers allow you to share their resources). Although these programs are not physically located at your computer, the network program makes it appear as if you are working on your own copy. You will also be able to print files using a server's printer and send messages to other computers. Sound exciting? Well read on ...

GETTING STARTED

What equipment do you need to get started?

Most of the equipment you need to operate the network is already installed. If you'd like, you can start working on the network without any materials at all. To work with one of the application programs, however, you will need a work disk. The standard 5 1/4 inch floppy disk will work fine to hold the work you plan to do.

Who is this tutorial for?

Whether you are reading this guide for the first time or have picked it up to look up a particular section, this tutorial can help you. If this is the first time you have worked with the PC Network, read straight through. If you have been working on the network for a while, feel free to browse through the guide and look up the particular section you'd like help with.

What is covered and what is not?

This is a user's guide intended primarily for the beginner and intermediate network user. It is assumed that you already know how to operate a personal computer and are familiar with the common terminology used to describe its use (if you are not, please refer to the introductory disk also available in this lab). In this tutorial, I introduce you to the basic concepts of computer networks and present the major functions that allow you to work on the network. This introductory document is actually a training manual. It was created to give you step by step instructions on how to perform a particular activity using the basic commands.

This is not a reference manual. It is not intended to provide you with technical information. Nor does it go into detail explaining how and why an operation is performed. If you are looking for more detailed information or a full explanation of all options, please refer to the technical manual titled "IBM Technical Reference: PC Network".

How do you use this tutorial?

To help you find your way through the tutorial, the training is divided into 12 chapters. Seven of these are basic training sections. These chapters will instruct you how to perform an operation. The other chapters are general information chapters. They are there to present you with information that may help you understand the following chapters. Before each chapter is a listing of the topics that will be covered and a brief introduction to the chapter. The last chapter provides a summary of all the tasks you can perform using the network.

TRAINING CHAPTERS

- Starting the PC LAN
- Accessing the Network Menus
- Exchanging Messages
- Applications and On-line Help
- Using the Printer
- The Network Status
- Leaving the Program

INFORMATION CHAPTERS

- Introducing the Computer Network
- Inside the PC Network Lab
- Menus vs Commands
- Summary of PC LAN Tasks
- About the Network Printer

Terminology

- **BOLD** print denotes the introduction of new computer terms and identifies action words and names of keys, files and devices.

- words in the angle brackets, **< >**, correspond to a key on the keyboard. The following keys are referred to throughout the guide:

carriage return key (or ENTER)

<CR>

control key

<CTL>

alternate key

<ALT>

print screen

<PRT SCR>

scroll lock / break

<BRK>

tab

<TAB>

delete

< DEL >

shift

<SHF>

insert

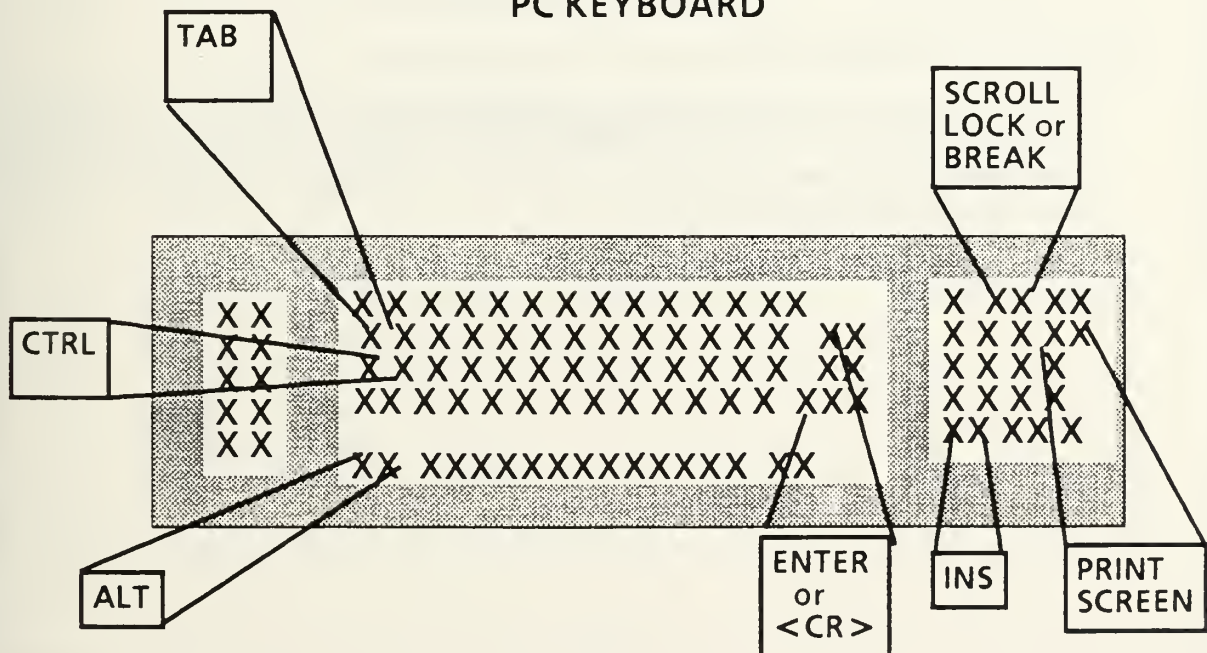
<INS>

All keys that you must press simultaneously will be presented with a hyphen in between.

That is, when you need to press the control, alternate and delete keys together, you will find the instructions presented as follows:

<CTL>-<ALT>-

PC KEYBOARD



More Terminology

-You will often see a command written like this:

<CR>;<CR>

This is not a typographical error. It means you are to press that key twice.

Interacting with the Computer

- The interactive section is written in italics. After you are told how to perform a task, you will be asked to do some form of that task. This is to provide you with some experience using the system before you attempt it on your own.

In trouble?

The "**problems**" pages contain information you may need while completing the training. These pages are located at the end of the training chapters and assist you in overcoming any difficulties you may be having. If you are not having any problems, good, just proceed on to the next section.

One more thing...

If your computer screen suddenly goes blank, don't worry. The system is equipped with an automatic screen saver. If you do not interact with the computer for a few minutes your screen will disappear. Press any key and your screen will appear again.

2. INSIDE THE PC NETWORK LAB

In this chapter you will learn about the hardware needed to operate a network that is limited to a small geographical area or single site. This type of network is called a **Local Area Network or LAN**. You will learn about the equipment we have in our lab, and also the other items that are needed to run a network. In addition, we will describe for you what happens when a transaction is processed.

In this chapter you will find the following information:

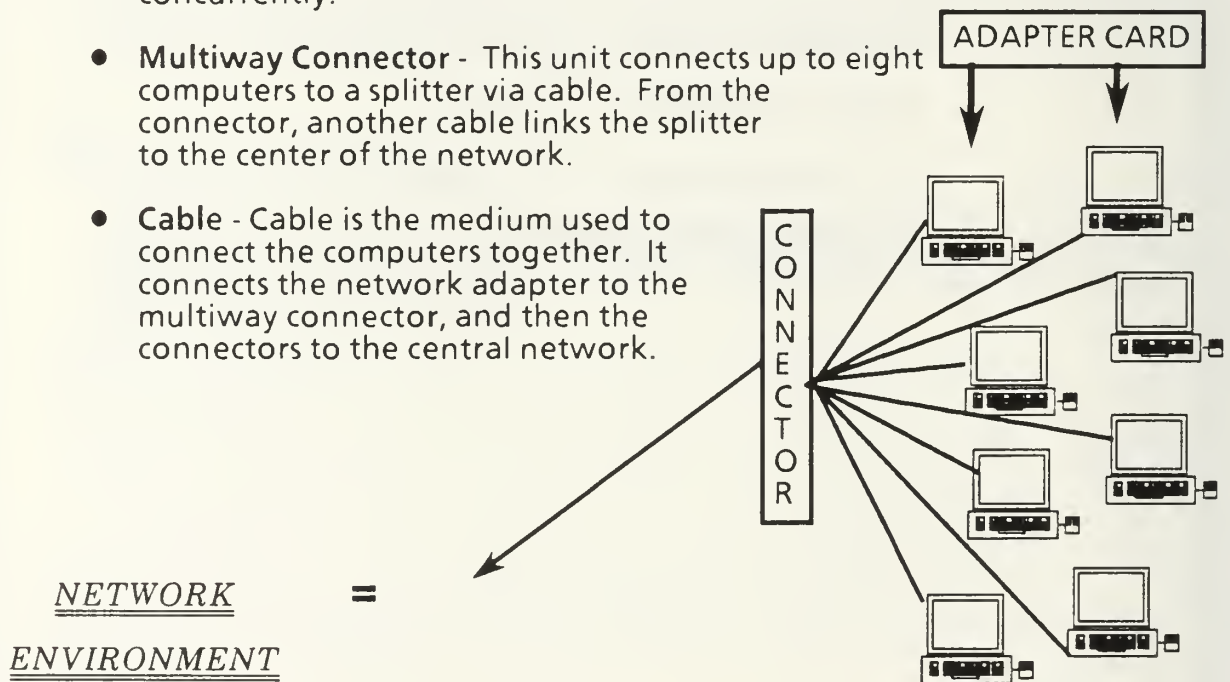
- What is needed to operate the IBM LAN
- What equipment is in the lab
- LAN Software and System Capabilities
- LAN Processing Operations

EQUIPMENT REQUIREMENTS

What basic hardware equipment is needed to operate the IBM LAN?

Before a computer can operate in the IBM Local Area Network (LAN), it must first be equipped with certain hardware:

- **A Network Adapter Card** - This is a circuit board that is inserted inside the computer. It provides the means to allow the computer to participate in network communication and processing by attaching each workstation to the communication media. The adapter card comes equipped with it's own **memory** and **processor**. Because of this, the computer's processor can be devoted solely to standalone computer functions allowing the adapter card to manage the communications processing of the network concurrently.
- **Multiway Connector** - This unit connects up to eight computers to a splitter via cable. From the connector, another cable links the splitter to the center of the network.
- **Cable** - Cable is the medium used to connect the computers together. It connects the network adapter to the multiway connector, and then the connectors to the central network.

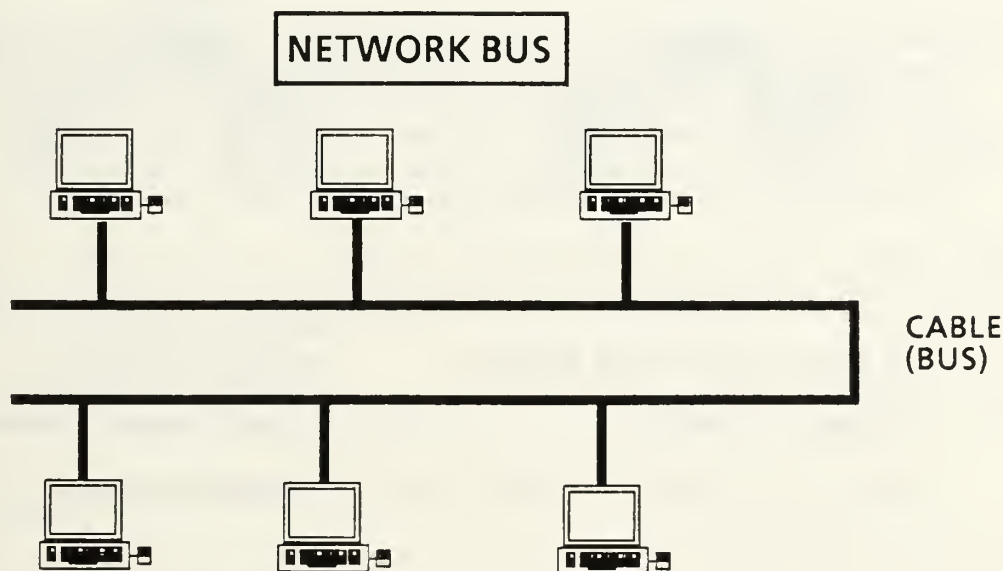


The cable helps to provide the LAN with its fast transmission speed. This system uses coaxial cable. This is a telephone type cable that is similar to that used for cable television. With coaxial cable, other forms of media, such as video and voice, are permitted to operate on the network in addition to the transferring of data.

NETWORK TOPOLOGY

How are the pieces of a LAN linked together?

The way in which the computers in a LAN are connected is known as the network **topology**. The setup used in our lab is known as a network **BUS**. This configuration consists of a cable that runs past all of the network workstations and to which they all are directly connected. All computers are peers so no one computer controls the network. This type of system works particularly well in LANs since the entire system will not fail if one workstation is not functioning.

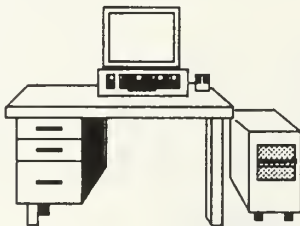


LAB EQUIPMENT

What equipment is in the lab?

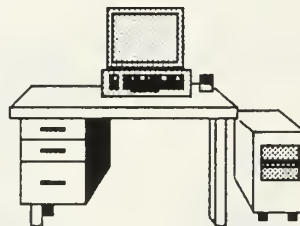
The computer lab is equipped with 25 IBM XT workstations and four IBM AT computers known as **servers**. The XT workstations are the computers that you will be working on. They contain two 360 kilobyte (k) disk drives and 640 k of main memory. The ATs are on the shelves and are only to be used by the **network administrators**. They have one 20 megabyte (Mb) hard disk, one 1.2 Mb floppy drive, one 360 k floppy drive and one Mb of main memory. In addition the lab is equipped with three dot matrix printers and a projector.

XT WORK STATION



- TWO FLOPPY DISK DRIVES
- 640 K MEMORY

AT SERVER



- ONE HARD DISK
- TWO FLOPPY DRIVES
- 1 MB MEMORY

Each type of computer performs a function based on its configuration in the network.

LAN SOFTWARE

What about the software needed for these machines?

In addition to the hardware components of a network, software is also needed to make the system go. Networks are so complex they need special software to handle the particular tasks they perform. Three different types of software are available on the system; the network software, the operating system software and the application software.

Network System Software - Every network uses a specialized set of programs known as a network operating system to control and direct the activities in the network. This task is accomplished by the **IBM Network Program**. The **IBM Network Program** acts as the overall network manager. Its primary functions are to move data between the network computers and to control the sharing of files. The network program consists of a number of small programs. Part of these programs are located on a diskette, and part is on the network adapter card. The programs that are on the adapter card are collectively called the **Network Basic Input/Output Services (NETBIOS)**. It is the **NETBIOS** handles all data transfer between the network computers and manages all lower levels of communications.

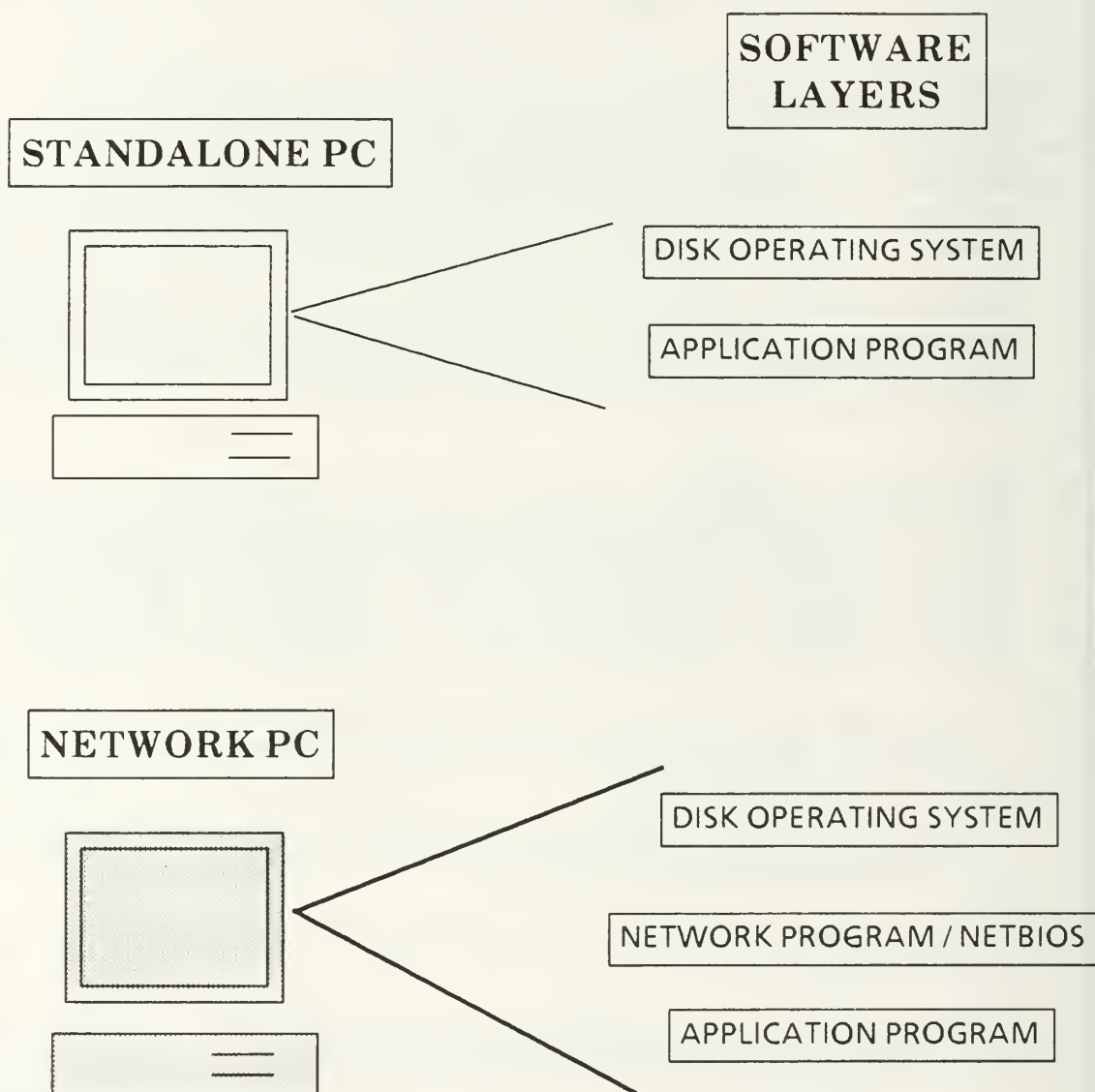
Disk Operating System - The computers also needs a program to manage and coordinate the communication between its hardware and software. This manager is **MicroSoft Disk Operating System (MS-DOS)**. **MS-DOS** was designed for single user applications and is only capable of performing one function at a time. While the network program is busy handling specific network functions, **DOS** is coordinating access to the system resources.

For example, printers are known by the **DOS** reserve names **LPT1**, **LPT2**, and **LPT3**. When you want to send a file to network printer **LPT1**, the following things happen:

- 1) **DOS** first identifies the name of the printer you wish to use and gives this name to the network program.
- 2) The network program then identifies which server the printer is attached.
- 3) Upon identification of the correct path to the printer, the file to be printed is transferred to the network program.
- 4) The network program in turn sends it to the server's operating system to print out.

Application Programs - The application programs are the shared programs that run on the network. These are programs, such as **DBase 3 Plus**, **WordPerfect** and **Lotus**, that you, the user will use. The application programs interact with **DOS** to receive data from a disk or keyboard; or to transport data to the monitor.

The most commonly used programs are listed in the main directory and are displayed when the network is started. **Batch files** have been written to make these programs easier for you to access.



COMPUTER CAPABILITIES

What capabilities do the lab computers have?

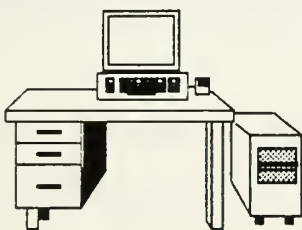
The network program allows four different types of configurations for each work station; **the redirector, the receiver, the messenger and the server**. Our lab uses the messenger and server configurations.

The XTs are programmed to run under the messenger configuration. Under this mode of operation the XTs can perform functions such as using a server's disk, directory or printer; sending and receiving messages; saving messages received from other computers; using another name to receive messages; transferring messages to another computer; and using the network request key to switch from local application processing to the network program.

The ATs are the servers. The servers can perform all of the same functions of the messengers. In addition, the servers also share their resources with the other computers.

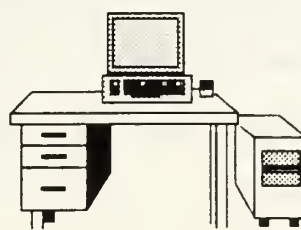
Consider this, a printer that is attached to a machine that operates as a server, can be shared by all the network computers; but a printer that is connected to a messenger machine, can only be accessed by the user of that machine.

MESSENGER



- send / receive messages
- save messages
- forward messages
- receive messages under another name
- switch from local processing to the LAN Program

SERVER



ALL THE MESSENGER FUNCTIONS PLUS ...

- share disk, directory, or printer with the network

PROCESSING OPERATIONS

How is the sharing of resources accomplished?

Networking allows computers to be involved in **multi-user cooperative applications**. This means that each user may share the use of physical resources belonging to another computer. The PC LAN permits the users to share the storage disk and printer of the computers that function as servers. The application programs you will be using are actually located on the fixed disk of these servers. You will be using these programs by obtaining access to your server's file, but will not actually be keeping a copy for yourself.

How does this happen?

Before a user can access a program, a number of things happen:

- 1) First the server must make the directory in which the file is located available to the user. This is normally done by programming a **batch file** to make certain resources available whenever the server is started up. In the PC Lab, the servers are always in operation so the server's resources are available on a continuous basis.
- 2) Then the user must request use of that directory. This request is executed automatically in a **batch file** when you start the LAN program.
- 3) Once the resource is made available and the request is initiated and accepted, the user is allowed access to the server's directory.
- 4) The user then selects the program he is interested in from the server's directory and the program is transferred into the computer memory of the user machine.

All of the steps described above are executed using batch files.

If you would like to use the **WORDPERFECT** word processing program the following processes must take place:

SERVER

USER

1) MAKE DIRECTORY "E " AVAILABLE
(continuous)

2) REQUEST USE OF DIRECTORY "E"
(automatic upon startup)

3) ALLOW USER ACCESS TO DIRECTORY "E "

SERVER'S DIRECTORY E

APPLICATION PROGREAMS

DBASE

LOTUS

WORDPERFECT

4) SELECT WORDPERFECT FROM
THE LIST OF PROGRAMS ON
DIRECTORY E

5) TRANSFER PROGRAM TO USER

TRANSFER
PROGRAM

6) WORK WITH WORDPERFECT

3. STARTING THE PC LAN

In this chapter you will learn how to start the network computer and gain access to the network environment. If you are a true beginner to computer networking, don't worry because that's just where I start ... from the very beginning.

In this chapter you will find the following information:

- How to start the LAN
- How to format a disk
- Problems starting the LAN

STARTING THE NETWORK

The network is actually in operation at all times since the four servers are always on. By starting the network, I mean starting the network program on your machine. The program is currently set up so that the PC LAN program is automatically invoked whenever you boot up the system.

1. Take the disk located on the desk from its jacket. With the label facing you and the silver notch pointing downward, push the disk into the first disk drive (drive A) until it clicks in place. Close the disk drive door by turning the latch so that it points down.
2. Turn the top dial, located on the right side of the monitor screen, to the right until you hear a click and see a green light come on (the dial should be on the 'O' position).
3. Reach over to the right side of the desk and find the red power switch on the computer. Now turn it on and wait.

Now follow the steps above to start the system.

While you are waiting the following things should happen:

- You will hear beeping
- You will see the the following comment repeated on the monitor screen several times:
"Command Completed Successfully"

This is an indication that the batch programs are being executed.

You know you have correctly started the network when you see a screen similar to this:

Drive E	Name	Ext	Size	Statistics	Toggles
select	Vdisk	32	Volume	Disk Usage	Main Menu
	Others		Sub-Dir	5 user files	Caps Print
	1Dir	Com	49823	41472 bytes left	Batch Edit
	DBase	Bat	861	52736 used	Set-up
	Help	Bat	27	96768 total	Pause On
	Lotus	Bat	101	Memory Usage	Sort Name
	Wrd_P	Bat	95	407392 left	Deflt E:
				247968 used	Displ E:
				65530 bytes total	

Today is

E > _____

Compose Copy Type Rename Erase Date Mkdir Options

This is the network main directory screen. It shows the names of programs that are installed on the network and other pertinent information concerning disk space and memory usage. As new programs are added to the network, this screen will be modified to reflect the new status.

You are now in the network environment and ready to begin your work.

You will need a formatted disk to hold your work . If your disk is already formatted, take the LAN program disk out of drive A, return it to its jacket and insert your formatted disk into drive A. If you do not have a formatted disk then turn to the next page for instructions on how to format a disk.

FORMATTING A DISK

How do you prepare a disk to work on the computer?

Before you begin to use one of the application programs you must first initialize or format a work disk. Formatting prepares a disk to receive and store the files that you will create.

To format a disk

1. At the **DOS** prompt (**E >**), type **format A: <CR>; <CR>** -
The system will prompt you to enter a new disk .

2. Take the **LAN** Program disk out of the drive and return it to the jacket that is secured on the desk. Insert your non-formatted disk in drive **A**; press **<CR>**

Your disk is now being formatted.

3. When formatting is complete you will see the following message:

Format another (Y/N)?

Type **Y** then **<CR>** if you have more than one disk to format.
Otherwise type **N** then **<CR>** to return to the **DOS** prompt (**E >**)

You should now be at the main directory. When you are ready to continue, turn to the next section.

PROBLEMS?

Possible Problem:

- if your screen looks like this:

```
.....
The IBM Personal Computer Basic
Version C1.10 Copyright IBM Corp 1980
62940 Bytes free
OR
—
1LIST 2RUN 3LOAD 4SAVE 5CONT 6LPT1 7TRON 8TROFF 9KEY 0SCRN
.....
```

Solution:

- Insert the disk that is on top of your desk and press <CTRL>-<ALT>-. The disk on your desk is already programmed to execute commands that will allow you to automatically start the network. You accidentally started the **BASIC** programming language.

Possible Problem:

- your command to format a disk is not being accepted

Solution:

- By typing the command "format" you cause the execution of batch commands to load the format instructions into the computer memory. If this does not work for you, insert the LAN program in drive A, then type A: <CR>; <CR>. At the A prompt, type format A: <CR>; <CR>. Format is an external command and must be read from a system disk with **DOS** on it before it can be executed. Insert your unformatted disk in the drive **after** the command has been read and the system prompts you to insert your disk.

4. ACCESSING THE NETWORK MENUS

Using the network menus is one of the quickest and easiest ways to learn how to use the system. With no commands to learn you just let the network guide you through the tasks you want to perform.

In this chapter you will learn the following:

- How to get to the Network Main Menu
- How to use the Menus
- The Menu Areas
- How to leave the Menus

GETTING TO THE NETWORK MENUS

The network menus provide the path from which you can perform all network tasks. You may perform such tasks as using the printer, sending a message, or checking the status of a particular device. The menu lets **you** choose the task you want to do.

Method 1

To access these menus you just press the network request key. The network request key is not a single key, but the three keys, **<CTL>-<ALT>-<BRK>** pressed at the same time.

Press these keys together now (careful, you will need both hands to press them together).

The following menu should appear:

PC LAN PROGRAM

Main Menu - Task Selection

1. Message Tasks
2. Printer or Print Queue Tasks
3. Disk or Directory Tasks
4. Network Staus Tasks
5. Pause and Continue Tasks
6. Save or Cancel the Network Setup

CHOICE

Method 2 - Using Commands

There is another way of accessing the network menus for people who are at the **DOS** prompt (i.e., **E >**) and prefer to use commands.

*First return to **E >** by pressing <CTL>-<BRK>
 then <CR>
(don't worry, I'll explain more about these commands later).
You should be at the network directory again.*

type **NET <CR>;<CR>** to enter the menus.

NOTE: Remember you must press **<CR>** twice to execute the command.

*Now try entering the network menu using the **NET** command.*

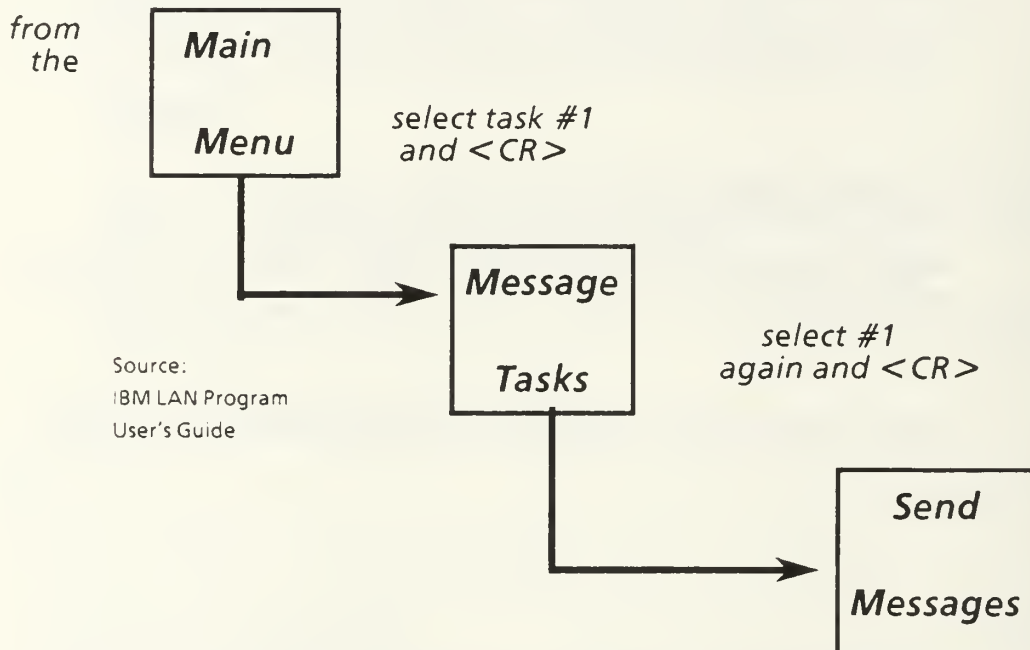
For more information about using the commands, turn to the next chapter.

- If you are at the main menu screen, read on, you're doing great.

Task Selection

When you select a task you will see another menu screen appear. Each menu lists more specific task descriptions. You will have to keep selecting the option that most closely resembles your task until you reach the action menu (this is the screen where the job is actually carried out).

For example, to send a message to another computer your path would look like this:



Upon completion of your task you can either go back to the main menu by pressing <CTL>-<HOME> or return to your application program by pressing <CTL>-<BRK>.

Now follow the steps above to get to the "SEND MESSAGES" screen.

Lets take a look at the menu areas.

Menu Areas

The menus are composed of several areas. They are:

- A. Fields
- B. Status Line
- C. Message Line
- D. Key Identifiers

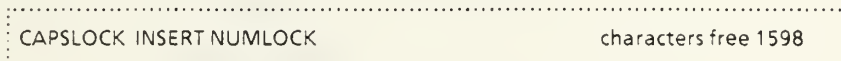
A. Field - This is the black area of the menu above the blinking cursor.



If there is more than one field in the menu you must use **<TAB>** () to move to the next field.

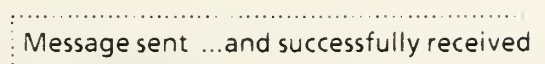
Press the <TAB> key to move to the next field. SURPRISE! You will hear warning beeps and an error message will appear on screen saying that this is a required field and cannot be left blank. Now type in a name and then press <TAB>. Any name will do since we won't really send a message until the next chapters. The cursor should now be in the message area of the screen.

B. Status Line - This is the white area located at the very bottom of your menu that displays what toggle keys are in use.



To see how this works press the CAPSLOCK, INSERT, and NUMLOCK keys. The status line should look like the one above. Press these same keys again to remove.

C. Message Line - This is the area at the bottom of your menu screen above the status line. In this area is displayed either task completion or error messages.



We will see this line used when we actually send a message.

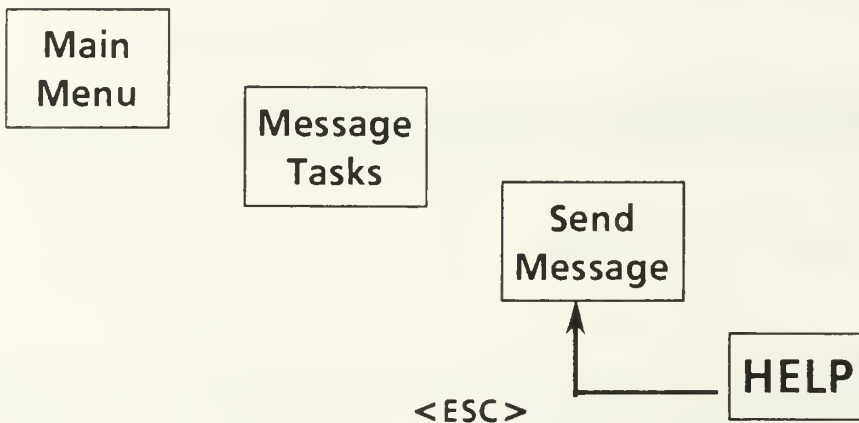
D. Key Identifiers - The names of the keys most often used with menus, are displayed at the bottom of the screen:

F1 - Takes you to a help screen that will assist you in completing a menu.



Press the F-1 key and read the information contained in the help file.

ESC - Takes you back to the previous menu.



Press the <ESC> key. You should be at the "SEND MESSAGE" screen.

F2 - Displays the command line where you can enter a PC LAN Program command rather than completing your task using the menus.

NET _____

Press the F-2 key. Notice that the NET portion of a command is already provided for you. Press <ESC> to return to the "SEND" screen.

<CTL>-<BRK> - Returns you to the last screen you were at before you entered the menus. After pressing these keys you will see the prompt:

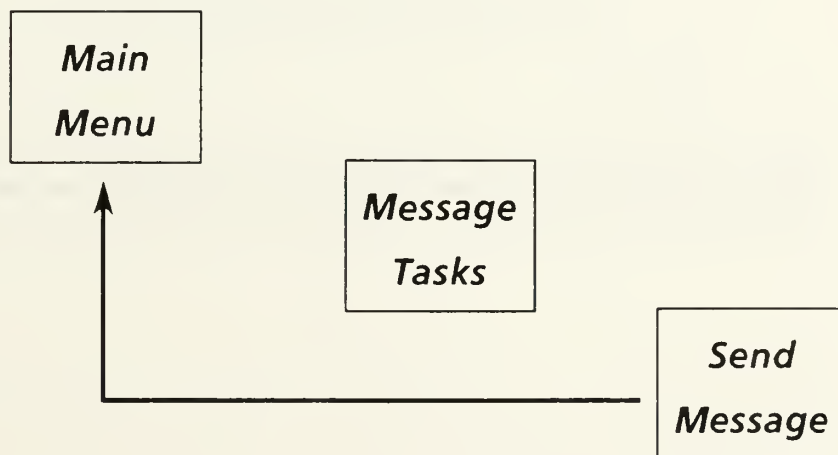
Are you sure you want to exit the menus? (Y/N) Y

Press **<CR>** to exit. If you change your mind and decide to continue to work in the menus, type **N** then **<CR>**.

*Press **<CTL>-<BRK>** then **<CR>**; (press any key when prompted); You will be returned to the network directory. Now see if you remember how to get back to the **SEND MESSAGE** screen. If you don't remember you can refer back to the beginning of the chapter.*

You should be at the "SEND" screen again.

<CTL>-<HOME>; - Takes you out of the menu you are now in and returns you to the Main Menu .
<CTL>-<HOME>






*Now press **<CTL>-<HOME>;** **<CTL>-<HOME>** to get back to the main menu. If you have found your way back to the Main Menu you are indeed learning the system quickly.*

*Now return to **E>** by pressing **<CTL>-<BRK>** followed by **<CR>**.*

EDITING COMMANDS

The following is a list of commonly used edit keys that may help you in your work:

	Moves the cursor to the left
	Moves the cursor to the right
END	Moves the cursor to the end of the line
HOME	Moves the cursor to the beginning of the line
CTL-END	Erases characters to the right of cursor
 (BACKSPACE KEY)	Deletes the character to the left of cursor
INS	Inserts characters without erasing anything
DEL	Deletes the character over the cursor

Now that you know how the menus work, you can start your work. There is however, one more thing you should know before you begin working on the network. To find out turn to the next section.

5. MENUS VS COMMANDS

This chapter is not interactive, but will help you understand the difference between the command mode of operation and the network menus.

This chapter contains information on:

- When to use menus
- When to use commands
- The commands you will use most

MENUS OR COMMANDS: **IS THERE A DIFFERENCE?**

Once you have entered the network environment there are two ways to input data:

using the menus
or
typing commands.

You can essentially perform the same tasks using either commands or the menu, so the mode you choose to use will depend on your personal preference.

MENUS

The menu mode is often easier for the beginner to use. Menus allow you to make a selection from a series of options until you perform your desired task. For the experienced user, this screen selection process may become a bit tedious so they often opt to use the command mode. Instructions on how to use the menus are presented in the other chapters.

COMMANDS

Each command consists of a brief sentence that starts with the word **NET**. While in this mode, one line of code will cause your instructions to be carried out.

You can enter a command from either the **DOS** prompt or the command screen that is within the menus.

To enter the command screen from a menu simply press F-2.

The network commands that you will find most useful are:

- NET USE** - to begin using (or stop using) a printer
 or to check the status of a device
- NET PRINT** - to print a file or check the print queue
 of one of the printers
- NET SEND** - to send a message to one or all of the
 network computers

NOTE: When sending a message using commands, there is an 80-character limit on the length of any one message.

Since you may find using network commands easier after you become more familiar with the network program, the following chapters will describe how to perform tasks using both commands and menus.

6. *EXCHANGING MESSAGES*

This network feature lets you send messages to and receive messages to your neighbors. You will be able to send a message to one person on the network or to everyone. You may choose to receive your messages under another name , forward your messages, view messages immediately or wait until a more convenient time.

In this chapter you will learn how to:

- Send and Receive Messages
- Receive Messages Under Another Name
- Log Messages to a File
- Forward Messages to Another Computer

HOW DO YOU EXCHANGE MESSAGES ON THE NETWORK?

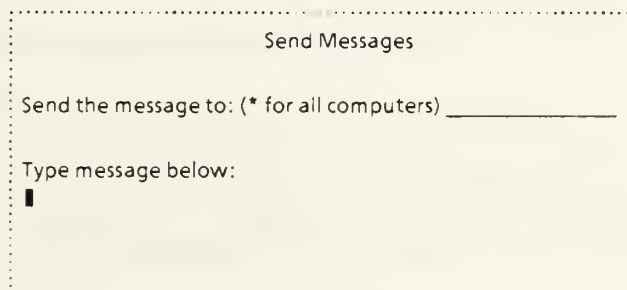
Sharing information is an important part of cooperative computing. In this network you have the capability to send and receive messages to other people working on a network computer. The message system works a little like an office intercom. You can send out messages, but the person must be there to receive it.

When you send a message, you will need to know the name of the computer that will receive your message. To determine this, just look on the computer monitor of your choice.

To Send a Message Using Menus

1. Press **<CTL>-<ALT>-<BRK>** to get to the **Main Menu**.
2. Select **Message Tasks** - press **1 <CR>**.
3. Select **Send Message** - press **1 <CR>**.

you will see the following screen:



```

Send Messages

Send the message to: (* for all computers) _____

Type message below:
|

```

4. Type the name of the machine that is to receive your message (or an **'*'** to send to all computers). Press **<TAB>**.
5. Type in your text. When finished type **<CTL>-<CR>** to send.

Following the instructions above, enter the name of a neighbor's machine and send him or her a message. If you're having trouble, remember to refer to the problems page at the end of this chapter.

There will be an advisory message at the bottom of the screen above the status line indicating what was done with your message, i.e.,

Message sent . . . and successfully received

Now return to *E >* (remember, *<CTL>-<BRK>* then *<CR>*)

To Send a Message Using Commands

From the DOS prompt or the menu command line, type:

NET SEND (RECEIVER NAME) (MESSAGE) <CR>;<CR>

Let's send the computer "Mark" the message "We have a Superintendent's Lecture today at 1500 ". Your command should look like this:

**NET SEND MARK WE HAVE A SUPERINTENDENT'S LECTURE
TODAY AT 1500 . <CR>**

*(If you are working with someone else, send him the message by substituting the name of his computer for "Mark".)
You should see a message indicating the status of your message.*

If you send a message to Mark and the computer "Mark" is not turned on, you will see that the network message's sending function does not work like computerized mail. The receiver must actually be logged on the network at the time the message is sent in order for the message to be received. The network does not have the capability to save a message for someone if the person is not on-line when the message is sent.

Return to E > by pressing any key.

ADDING ANOTHER NAME FOR RECEIVING MESSAGES

Often it is not convenient to remember the names of computers. It may be easier for someone to send you a message by your first name, rather than by the name of the machine you are working on.

If you'd like to receive messages by your first name instead of the name of your computer, just add your name to the list of names your machine can receive messages under. But remember, any additional names added to the network, must be unique. If your name is already the name of a computer, or someone else is currently using that name to receive messages, you must use another name.

To Add a Name Using Menus

1. Press **<CTL>-<ALT>-<BRK>** to get to the **Main Menu**.
2. Select **Message Tasks** - press **1 <CR>**.
3. Select **Start or Stop Receiving Messages for Another Name** - press **4 <CR>**.
4. Select **Start Receiving Messages** - press **1 <CR>**.

you will see the following screen:

RECEIVING MESSAGES FOR ANOTHER NAME

1. Start Receiving Messages for Another Name

2. Stop Receiving for Another Name.

► Choice

Start receiving messages for:

5. Type in a name and press **<TAB>** (the name must be no more than 15 characters and no blanks). The network will beep and a message will appear at the bottom of the screen: Specified name ready to receive messages.

Now try out the steps above and add your name , nickname or CB "handle" to the list to receive messages.

To Add a Name Using Commands

From the DOS prompt or the menu command line, type:

NET NAME (NEW NAME) <CR>;<CR>.

To View the Names for Receiving Messages

You can view the names that your computer receives messages under. This function can be performed using menus or commands.

Using Menus

1. Press <CTL>-<ALT>-<BRK> to get to the Main Menu.
2. Select Message Tasks - press 1 <CR>.
3. Select Display names which can receive messages.

You should see a list of your computer's name and any other name you have designated to receive messages.

Using Commands

From the DOS prompt or the menu command line, type:

NET NAME <CR>;<CR>.

To Exit the View Screen

1. Press <ESC>;<ESC> then <CR>. You will be returned to the screen you were looking at before viewing the message.

Let's try out this feature by sending two messages. Send one message to someone using their computer's aname, and another to someone using their first name. The next section will describe how to view these messages. Now return to E >.

RECEIVING AND VIEWING MESSAGES

When you receive a message, you may chose one of three different ways to view it:

- 1) to see the message as soon as it is received, or
- 2) to save the message , and view it at a later time, or
- 3) to save your messages to a file on your diskette.

The PC Network will inform you when you have a message by sounding a beep. You will then see a message such as this printed on top of the screen you are working on:

ie. Message from Siv or Message waiting 1

Viewing a Message as Soon as it is Received (from DOS or an Application Program)

1. Press <CTL>-<ALT>- <BRK> to get to the View Messages screen

At the bottom of the screen there is a note indicating the number of messages you have waiting to view. Your most recent message will automatically be displayed first.

2. To view the next message, press <F3>.
3. To answer a message, switch to the "send" screen - press <F4> . and follow instructions on page 35. To switch back to the "view" screen press <F4> again.
4. To print out this message , press <F8>.

If you are working on this tutorial with someone else and have received a message, follow the steps above to view and print it out. Otherwise proceed to the next section.

Saving Your Messages to View at a Later Time

The network can save your messages in two places:

in the network's message buffer or in a file you designate.

When you save your messages in the network buffer, it is only a temporary arrangement. In other words the messages saved in this buffer can be lost if the system is reset or the power is turned off.

To save your messages this way, do nothing when you see a display telling you a message is waiting. Your message will be saved to the network message buffer automatically and you may continue working in your application program until you are ready to view the message.

Viewing a Saved Message

1. Press **<CTL>-<ALT>-<BRK>** to get to the Main Menu.
2. Select Message Task - press **1 <CR>**.
3. Select View Message - press **2 <CR>**.
Your message will be displayed.
4. To view another message saved, press **<F6>**.
5. To answer a message, press **<F4>** and follow the instructions on page 35.

The next time you receive a message, wait about five minutes and then follow the steps above to view it.

If you expect to receive many messages, the buffer designated to hold them may not be large enough. If someone sends you a message and there is no room in your buffer to hold it, the sender will receive an error message such as this:

Message sent but not received

As the recipient of the original message, you will not receive an error message and therefore will not know that your buffer is full. Without a hint that your buffer is full, it is unlikely you will take any action to rectify the situation (such as reading some of the saved messages in your buffer to make room for new messages).

In this instance you may decide to save your messages in a message log.

Logging Your Messages in a File Using Menus

If you choose, you may save all of the messages you receive in a file or log. As your messages come in, they will be intercepted and sent to a file on your scratch disk until you decide to view them. To view your messages:

1. Press **<CTL>-<ALT>-<BRK>** to get to the **Main Menu**.
2. Select **Message Tasks** - press **1 <CR>**.
3. Select **Start or Stop Saving Messages** - press **3 <CR>**.
4. Select **Start Saving Messages** - press **1 <CR>**.

You should see the following screen:



A screenshot of a menu screen titled "START OR STOP SAVING MESSAGES". The screen is enclosed in a dotted rectangular border. It contains the following text: "1. Start saving Messages", "2. Stop Saving Messages", "► Choice", and "Save messages in filename or DOS device" followed by a horizontal line for input.

5. Enter the name you wish to call your file and press **<CR>**.

If done correctly, you should see the following message:

Messages being saved

and you will be automatically returned to the **Message Tasks** screen.

Logging Your Messages in a File Using Commands

From the DOS prompt or the menu command line, type:

NET LOG (FILE NAME) <CR>;<CR>.

If you simply type in the name of a file, all of your messages will be saved to this file on a disk in your default drive A.

You may also save your messages on another disk drive by specifying the name of the drive before you name your file.

For example, to save your messages in a file called Msg.log to drive B, at the start saving message prompt, type:

B: Msg.log <CR>;<CR>

or if using commands, type:

NET LOG B: Msg.log <CR>;<CR>

This file will remain in effect until you log off the system. To save your messages in this log during future sessions on the network, you must initiate your log file using the steps above.

For this tutorial we are only working with one disk, so we will have to save our messages on drive A. Let's initiate a message log file. Call it whatever you like, msg.log is just an example. When through return to E >.

To View Status of Log File

Surprisingly, you can only view your message log status from the command screen.

From the DOS prompt or the menu command line, type:

NET LOG <CR>;<CR>.

You should see a table, listing the status of your log file, that is similar to this:

NET LOG	
Status	Name of Log File
on	B: Msg.Log

To verify that we have actually created a log file type in the command above. Now return to the E >.

FORWARDING MESSAGES

It may be necessary to receive a message at another machine that you will be working on temporarily. Rather than saving your messages at your original machine, just have them forwarded. For instance, suppose you are working at machine **A**, but must leave to work on machine **B** for a special project. The network's forwarding option allows you to reroute the messages sent to you at machine **A** and receive them at machine **B**. This can be done even when machine **A** is turned off.

To Forward a Message

1. Press <CTL>-<ALT>-<BRK> to get to the Main Menu.
2. Select Message Tasks - press 1 <CR>.
3. Select Start or Stop Forwarding Messages - press 5 <CR>.
4. Select Start Forwarding Messages - press 1 <CR>.

The following display will appear:

```
Start or Stop Forwarding Messages

1. Start Forwarding Messages
2. Stop Forwarding

• Choice

Forward messages for (name on your computer)
_____

To (name on another computer)
_____
```

5. Type the name of your computer and press <TAB>.
6. Type the name of the computer to which your messages will be forwarded - press <CR>.

*Follow the steps above to forward your messages to another machine and have a friend send you a message. You should not see this message at all. Now go to the computer you designated as your forwarding machine. and use one of the retrieval methods mentioned earlier to view the message.
When done, return to E >.*

PROBLEMS?

Possible Problem:

- The message waiting note disappears from the screen before you are able to view the message.

Solution:

- The note indicating you have a message will automatically be erased from your screen after about a minute. Don't worry, the message will be saved until you are ready to view it. When you are ready to view it:

1. Press **<CTL>-<ALT>-<BRK>** to get to the **Main Menu**, then follow the instructions for viewing a message from the menus.

Possible Problem:

- You receive an error message.

Solution:

- You may have pressed an illegal character while you were typing a computer name. Reenter the name and press **<TAB>** to move to the next field.

7. ABOUT THE NETWORK THE PRINTER

To understand the way a network printer operates you must first be introduced to some basic concepts . In this chapter we hope to take some of the mystery out of the network print function by presenting an overview of what happens when a file is sent to a printer.

This chapter will provide you with the following information:

- What happens during a network print operation
- Printer Terminology
- The difference between an ASCII file and a NON-ASCII file

NETWORK **PRINTING**

The Network Print Operations

The network printing task is divided into three separate phases:

1. Accepting files to be printed and assigning them to a waiting area.
2. Displaying a list of jobs that are waiting to be printed.
3. Transferring jobs to the appropriate printer.

When you print out a file the following things happen :

- All print jobs that are submitted to the network are sent to an area known as the **print spooler or buffer**.
- The buffer assigns a number to each print job based upon its arrival time. This information is presented on a list known as the print queue.
- As the job enters the print queue, it is assigned to a printer. Your files will be sent to the printer indicated on the right hand corner of your desk unless you tell it otherwise.
- Jobs are printed on a first come first serve basis. When your job comes to the top of the queue the network program sends it to the appropriate printer and the printer starts to print your job.

As you can see, network printing is a complex operation. This printing is further complicated by the way in which the network handles the printing of different types of files created.

ASCII and NON-ASCII Files

When a file is created it is either in **ASCII** or **NON-ASCII** format. ASCII is the code used to represent the characters in a file. The ASCII files you create are actually DOS text files. Printing an ASCII file is simple. Just follow the instructions listed in the next chapter. Printing NON-ASCII files, however, require a little more explanation.

Files created with a word processor such as Word Perfect are normally saved on your disk in the NON-ASCII format. The programs on the network that produce NON-ASCII files actually create files that contain special formatting codes. To print such a file, these special formatting codes must be removed and replaced with codes that DOS can recognize. This is done by a special conversion procedure performed by the network. To print a NON-ASCII file from one of the application programs you must go through the following process:

1. Print out a file using your application's normal print procedure .
2. Then press **<CTL>-<ALT>-<PRT SCR>**.

Why do you have to go through this process to print a file?

When you use WordPerfect's "print" command, your file will not be directly printed out. Rather it is sent to the server's **buffer** where the NON-ASCII code is converted to code the network understands. The buffer will hold all of your print jobs until you are ready to print them. When you are ready to print, you must tell the system so. You do this by putting an end of file (**EOF**) marker on your file. The **EOF** marker is **<CTL>-<ALT>-<PRT SCR>**. When you press these keys your files will be sent to the print queue. If there are no other print jobs before you, your print job will be sent directly to the printer and the printer will start to print all of your files stored in the server's buffer.

Even if you do not put an **EOF** marker on your files, they will be printed out anyway when you leave the application program.

Now that you understand why the network print operations must be performed, lets proceed to the next chapter for instructions on how to actually print a file.

8. *USING THE PRINTER*

This chapter will lead you through the steps involved in printing a file. The network will allow you to print out a file on a printer that is attached to another computer. You may also send that file to any printer located in the lab.

In this chapter you will learn:

- How to print out files
- How to send your files to different printers

HOW THE NETWORK PRINTER WORKS

To print a file from an application program, you must first determine whether the file was created in ASCII or NON-ASCII format (this information should be given to you in the program's documentation). If your program creates its files in ASCII format, refer to next pages. If you use a program such as the WordPerfect word processing program, follow the instructions below.

Printing a NON-ASCII File

1. Select the program's "PRINT" option. Instructions for WordPerfect are on the next page.
2. Wait for the disk drive processing light to go off.
3. Press <CTL>-<ALT>-<PRT SCR> to print out this file on a network printer.

For this tutorial I have provided some of the basic WordPerfect instructions that allow you to create and print out a file. If you already know how to use WordPerfect, skip to the bottom of the next page for your next exercise.

Basic Instructions on How to Create and Print a WordPerfect File

- Make sure you are at E >, then type
WRD__PRFT and press <CR>; <CR>.
- A series of commands will appear on the screen. This is **DOS** trying to find the correct path to the WordPerfect file located on your server's disk.
- You will then see the Word Perfect screen and a message telling you to wait.
- After a few seconds, a blank screen will appear. You may now start typing your file.
- To save this file, press <F10>. A message should appear at the bottom of your screen asking you for a file name. Type **Tutor** <CR>.
- To print the file, type <SHIFT>-<F7>. All of the print options are now at the bottom of the screen. Select the **full text** option by typing the number **1**.

Now refer to the network "print" procedures for instructions on how to print a non-ascii file from an application program.

- To exit press <F7> then the letter **N** (so you do not save the document again); then **Y** to exit the wordprocessor. When prompted, press any key to return to E >.

Create a short file (about 2-3 sentences will do), and save it. Now stop, call up the network menus and send a message to someone in the room. Wait for the confirmation that your message was successfully received and then return to WordPerfect. Now send the file you just created to the printer attached to your server. When complete return to E >. Having trouble? Refer to the problems page at the end of the chapter.

This exercise will demonstrate the flexibility of the network. You are able to use a program, pause in the middle of your program to perform a network function, then return to the exact place in your program that you left.

To Print an ASCII File Using Menus

1. Press <CTR>-<ALT>-<BRK> to get to Main Menu.
2. Select Printer and Print Queue Tasks - press 2 <CR>.
3. Select Print a file - press 3 <CR>.

The following screen is displayed:

```

PC LAN PROGRAM

Print a File

Dos name for your computer printer
____LPT1_____(LPT1, LPT2 ..)

File to be Printed
_____
```

4. Press <TAB> to move from the first field (the DOS name for a printer should already be entered). To send the file to another printer, type in the DOS name, then press <TAB>.
5. Type the name of the file to be printed.
6. Press <CR> to execute.

You should see a message like this displayed at the bottom of your screen:

You should see a message like this displayed at the bottom of your screen:

Your files will be printed out on the printer specified on the colored tab located on the right hand corner of your desk near the LAN start up disk.

To Print an ASCII File Using Commands

From the **DOS** prompt or the menu command line , type:

NET PRINT A:(FILENAME) (DOS PRINTER NAME) <CR>

For example: (This is just an example. Do not attempt to do this unless you have already created an **ASCII** file.)

To print out a document called **PRACTICE**, do the following:

1. Look on your desk to get the name of your printer (for this example we'll pretend the name is **LPT1**).
2. Make sure the disk containing the **PRACTICE** file is in drive A.
3. Type **NET PRINT A:PRACTICE LPT1**.

NOTE: YOU WILL NOT SEE A CONFIRMATION MESSAGE

Picking Up Your Printout

When you pick up your print job, you can identify it by the separator page. The separator page is a computer printout that contains the name of your machine. It marks the beginning of your job so you can easily identify your printout.

The previous sections of this chapter described the various ways to print a file. There is, however, one more method.

Normally, files you send to be printed will be sent to the printer indicated on your work station. There may be times when you want to send a file to another printer. For example, if someone is printing out their thesis, it may be quicker to send your file to another printer.

To do this, you must first stop using the printer assigned to you, then start using another printer.

To Send a File to Another Printer :

1. Press <CTL>-<ALT>-<BRK> to get to the Main Menu.
2. Select **Printer or Print Queue Tasks** - press 2 <CR>.
3. Select **Start or Stop Using a Network Printer** - press 2 <CR>.
4. Select **Stop Using a Network Printer** -press 2 <CR>;<CR>.
5. Press <ESC>, then press 2 <CR>.
6. Select **Start Using a Network Printer** - press 1 <CR>.

You should see the following screen:

Start Using a Network Printer

Printer is on Computer

Network Name for Printer

DOS name on your computer for the network printer
LPT1 (LPT1, LPT2, LPT3)

Password for Printer (optional)

7. Enter the **computer name** of desired server - press <TAB>.
8. Enter the **network name** of that server's printer - press <TAB>.

To understand where to get the above information turn to the next section.

Problems?

Possible Problem:

- You receive one or more error messages.

Solution:

- Make sure the disk that contains your file is in drive A.
- Make sure you spell the file name correctly.

Possible Problem:

- your print file is split into two separate files.

Solution:

- You are pressing <CTL>-<ALT>-<PRTSCR> too soon. Wait until your entire file has been sent to the server. The disk drive light will go out when the entire file has been read. After the light goes out then press <CTL>-<ALT>-<PRTSCR>.

9. THE NETWORK STATUS

It is often important to check the status of the network devices. You may need to determine whether you will use a particular device, find out what position your job occupies on a server's printer or just find out what the network name of a device is. This chapter enables you to view a server's print queue, and to see what devices you may use on the network.

This chapter describes:

- How to check the status of a network device
- How to read the network status screen
- Problems you may be having

CHECKING THE STATUS OF THE NETWORK

There will be times when you will want to check the status of a particular piece of equipment on the network. You may want to know whether a particular device is up or down, or find out the computer, network or DOS names for another printer.

The status most often checked is the status of a printer. Every file that is submitted to be printed on a network printer is sent to the end of a printer's waiting line and assigned a job number. You can determine what position your file holds on the waiting line (queue) by its job number.

To Check Your Job Status on a Printer's Queue Using Menus

1. Press <CTL>-<ALT>-<BRK> to get to the Main Menu.
2. Select **Print and Print Queue Tasks** - press 2 <CR> or **Network Status** - press 4 <CR>.
3. Select **Check Print Queue on Another Computer** - press 1 <CR>.

A screen is displayed that looks like the one below.

IBM PC NETWORK

Check Print Queue on Another Computer

Computer name: _____

4. Enter the name of your server and press <CR>
(look at the tab on the right side of your desk for your server's name)

The network will display a list of your jobs waiting to be printed.

The screen should look something like this:

Pos	ID	Size	Date	Time	Status
--No files in Queue--					

Pos - is the position of your file in the waiting line.

ID - is the job number assigned by the network (max is 99).

Size - is the number of bytes in the file.

Date / time - is the time and day you submitted your job.

Status - indicates whether your job is printing or waiting to be printed.

To Check Your Job Status Using Commands:

From the DOS prompt or the menu command line, type:

NET PRINT (SERVER NAME) <CR>;<CR>

For example, to check your print jobs on server **Ben**, type:

NET PRINT BEN <CR>

Note: Use the backslashes located in the lower left area of your keyboard. Also, make sure there are no spaces between the two backslashes and the server's name.

If there are no print jobs waiting, you will see the following network advisory:

No entries in list

Now check the status of your jobs on your server using commands or the menus. If using commands, refer to the example above substituting the name of your server for the name "BEN".

After you have viewed this screen return to E >

You may need to know the names that the network gives to the devices on the network. The network assigns special names to devices in much the same way that DOS identifies a printer by a name. This information is useful to you because:

- 1) You know what devices you may use while you are on the network.
- 2) You may need to know the DOS, Network and Computer names for a device on the network.

For example, you may be working on a computer that is using the printer attached to the server, Ben. If you know someone else is in the process of printing out a long document, you may want to send your print job to the server, Caryl, to be printed. To find out the names that the network needs to redirect this file to Caryl's printer, you must either get out of your seat and look up these names on Caryl's workstation, or check the display of network devices you are authorized to use.

TO DISPLAY YOUR NETWORK DEVICES USING MENUS:

1. Press <CTL>-<ALT>-<BRK> to get to the Main Menu.
2. Select *Disk or Directory Tasks* - press 3 <CR>.
3. Select *Display Network Devices you are Using* - press 2 <CR>.

You will see a screen similar to this:

Status	Dos Name	Computer Name	Network Name
	D:	Ben	/Disk D
	E:	Ben	/Disk E
	K:	Norms	/Apps
	M:	Ben	/Apps
	N:	Barry	/Apps
	LPT1:	Ben	/Print3
	LPT2:	Norms	/Print 1
	LPT1:	Caryl	/Print2
		- End of list	

This is a list of the resources you may use while working on the network.

TO DISPLAY YOUR NETWORK DEVICES USING COMMANDS

To display a list of the devices and directories you are using, type:

NET USE <CR>;<CR>.

Let's see what devices you have access to. Follow the instructions above, first using the menus and then the NET USE command.

Return to E >.

Now that you understand how to look up the names of the network devices, let's reintroduce the steps involved in sending your file to another printer.

To Send a File to Another Printer Using Menus:

1. Press <CTL>-<ALT>-<BRK> to get to the Main Menu.
2. Select **Printer or Print Queue Tasks** - press 2 <CR>.
3. Select **Start or Stop Using a Network Printer** - press 2 <CR>.
4. Select **Stop Using a Network Printer** - press 2 <CR>; <CR>.
5. Press <ESC>, then press 2 <CR>.
6. Select **Start Using a Network Printer** - press 1 <CR>.

You should see the following screen:

Start Using a Network Printer

Printer is on Computer

Network Name for Printer

DOS name on your computer for the network printer
LPT1 (LPT1, LPT2, LPT3)

Password for Printer (optional)

To enter the information for the printer you'd like to use...

This is where the Network Display of Devices you were using comes in handy. Go back to the previous page. Follow the instructions that lead you To Display the Network Devices You are Using. From the display screen get the computer name and the network name of one of the other printers in the lab. Now follow the instructions above to use another printer, then continue with the instructions below:

5. Enter the **computer name** of desired server - press <TAB>.
6. Enter the **network name** of that server's printer - press <TAB>; <CR>.

Try to send your practice document to another computer and return to E >. Now when you print out a file it will go to the new printer

PROBLEMS?

Possible Problem:

- You are not able to use the **NET PRINT** command to check the status of your print jobs.

Solution:

- Make sure you use backslashes rather than forward slashes.
- Make sure when using the **NET PRINT** command that there is no space between the two backslashes and the server's name.

10. APPLICATION PROGRAMS AND ON-LINE HELP

Since you will want to use some of the programs on the network, this chapter will show you how to gain access to these programs. If you require online help while working on the network, help menus are available to assist you.

This chapter will describe:

- How to access Application Programs from the Network
- How to use your own programs on a network computer
- How to access the Online Help Screens from the Network

USING APPLICATION PROGRAMS

One of the benefits of a computer network is the ability to share programs among users. Once a program is installed in the server's directory all users are able to gain access to it. This relieves the users from the inconvenience and expense of keeping individual copies.

To Start an Application Program From the Main Directory

- 1) Take the network program disk out of drive **A** and insert your work diskette. If your disk is **not** already formatted turn to the **Starting the PC LAN** section for instructions on how to format a disk.
- 2) Use the up and down arrow to select the program you wish to use.
3. Press **<CR>; <CR>**. Wait a few moments while the network locates the program on the server's directory. The program is located by the execution of a batch file which finds the program on the directory and establishes drive **A** as the default drive for your data disk. Soon you should see the program's logo. You may now use the program as usual.

To Start an Application Program From the DOS Prompt

- 1) At the **DOS** prompt, type in the network name of the program. Be careful since the programs may be spelled a little differently than you are use to. For instance,

To get to:

Word Perfect
D-Base III Plus
Lotus 1,2,3

type:

WRD__PRFT
Dbase__3P
Lotus

- 2) Press **<CR>; <CR>**.

- In addition, other programs will be available for you to use while you are working on the network since new programs will be added periodically, throughout the life of the system. Refer to **appendix A** to see a listing of the latest programs available on the system.

USING YOUR OWN PROGRAMS

In addition to the programs installed on the network, you may wish to use some of the your own programs. If so, you may use one of the network computers as a stand-alone computer.

To do this, just start your program the way you normally do without booting the system up with the **LAN** program disk on your desk. The **LAN** program utilizes about 183 k of memory and each XT workstation has 640 k of memory. If you start the **LAN** you are automatically reducing the amount of memory available for your program to about 457 k.

If your program requires less than 457 k to operate and you will be printing out files, it is probably easier to work within the network. Simply start the **LAN**, then switch to drive **A** by typing **A: <CR>; <CR>** at the **E>**. Take out the **LAN** program disk and start your program as usual. If your program requires more than 640 k it cannot run on the computer. The extra power of the ATs cannot be accessed unless you are operating in the network environment.

To print out a file using one of the network printers you must be in the network environment. If you are working on your own application program, and using your computer as a stand-alone machine, you must save your file to disk, then boot up the network and print your file using the instructions described in the print chapter.

GETTING ON-LINE HELP

Although most of the information you need to work on the network can be obtained from this manual, there are times when it would be more convenient to have the information available to you on the computer screen. Well, we have thought of that too!

The network is installed with on-line help screens to aid you in determining how to perform a particular function, how the network environment works and how to access a program on the network.

Getting to the help file is easy. From the main directory, use the up or down arrow to select the help option, or type **HELP** at the **DOS** prompt. You will first see an acknowledgment to Professor Schneidewind thanking him for all the time and effort he devoted to the creation of this lab. Press any key and you will be prompted through the rest of the help file.

For practice, let's try getting to the HELP screens by following the instructions above. After viewing all of the HELP screens, return to E > by pressing <ESC>; then pressing any key when prompted.

11. LEAVING THE PROGRAM

In this chapter you will learn what to do when you want to leave the network.

The following information is contained in this chapter:

- How to depart the PC LAN

LEAVING THE PC LAN PROGRAM

To Leave The Network

1. Exit your application program . Usually typing **QUIT** or **EXIT** will get you out of most programs and take you back to the main directory.
2. Exit the LAN by turning off your machine.

You should already be at the main directory.

Before you leave :

- Make sure the disk drive light is off. Now take out the disk.
- Turn off the monitor.
- Turn off the power switch.

12. SUMMARY OF PC LAN TASKS

Congratulations! You made it through the tutorial. The first time you work on the network things may be a bit cumbersome, but believe me you will get better with time and practice.

If you intend to continue working with the network you will probably be referring to this guide again to clarify concepts, help you with problems you may be having or just for general network information (the introductory sections will also make more sense the second time around!). If you are like me, you will often just be interested in the basic commands needed to perform a task. This chapter provides you with a summary of the tasks you can perform and the commands to accomplish them. For more detailed information, however, you will have to refer to the pertinent sections inside the guide.

SUMMARY OF PC LAN TASKS

1. STARTING THE LAN

- a. Insert LAN Program in drive A
- b. Turn on monitor
- c. Turn power on

2. SENDING MESSAGES

FROM MENUS

- a. press <CTL>-<ALT>-<BRK>
- b. select message task <CR>
- c. select send message <CR>
- d. type computer name <tab>
- e. type message
- f. press <CTL>;<CR> to send

USING COMMANDS

NET SEND (NAME) (MSG)

3. RECEIVING MESSAGES

FROM MENUS

- a. press <CTL><ALT><BRK>
- b. press F3 to view message

4. USING THE PRINTER

ASCII FILES

FROM MENUS

- a. press <CTL>-<ALT>-<BRK>
- b. select print and print queue tasks
- c. select print a file <CR>
- d. press <TAB>
- e. type filename <CR>

USING COMMANDS

NET PRINT A:(FILENAME)(DOS
PRINTER NAME) <CR>

NON-ASCII FILES

- a. use application program print procedure
- b. press <CTL>-<ALT>-<PRTSCR>

5. VIEWING THE NETWORK STATUS

FROM MENUS

TO VIEW YOUR JOB STATUS

- a. press <CTL>-<ALT>-<BRK>
- b. select print and print queue tasks <CR>
- c. select check print queue <CR>

COMMANDS

NET PRINT// (SERVER) <CR>

TO DISPLAY NETWORK DEVICES

- a. press <CTL>-<ALT>-<BRK>
- b. select disk or directory tasks
- c. select display network devices

COMMANDS

NET USE <CR>

6. ACCESSING APPLICATION PROGRAMS

FROM THE MAIN DIRECTORY

- a. insert work disk
- b. select program from directory <CR>

FROM THE DOS PROMPT

- a. insert work disk
- b. type application shortname <CR>

7. ACCESSING ON-LINE HELP

FROM THE MAIN DIRECTORY

- a. select Help from the main directory

FROM THE DOS PROMPT

- a. type HELP <CR>

8. QUITTING

- a. exit from application program
- b. take out disk
- c. turn off monitor
- d. turn off power

GLOSSARY OF COMPUTER TERMS

Application Software - A set of programs that direct the computer to solve problems or applications to users (ie. spread sheets, word processing, data base management systems).

ASCII - The information coding scheme used with computers to represent letters, numbers and symbols. An acronym for American Standard Code for Information Interchange.

Batch file - A text file that contains a program that consists of a sequence of DOS commands.

Bit - The smallest quantity a computer can measure or detect.

Buffer - A block of memory used for temporary storage during the data transmission between two devices.

Boot - To load and run a program.

Bus - A group of conductors used as a path over which data can be transferred between memory, disks and printers.

Byte - The unit of measure for computer memory and disk storage. One byte contains 8 bits and encodes 1 character.

Coaxial Cable - Cable used for data transmission where central wire is surrounded by a tubular conductor.

Cursor - An indicator on the screen that shows where the next characters will be entered.

Data - The numbers and text used by computers to do its work.

Data Communications - The transmission of data from 1 location to another.

Device - A piece of computer equipment that performs a specific task.

DOS - Trademark name for the operating systems produced by IBM and Micro Soft.

Directory - A list of files available on a disk.

Disk - A magnetically coated disk that is used to store files.

Disk drive - The device that rotates a disk in order to read (retrieve) and write (store) files.

File - A collection of related data records stored on a disk.

Format - To prepare a disk for use.

Hard Disk - The equipment that makes up a computer system.

Kilobyte (k) - 1024 bytes (usually rounded to 1000).

GLOSSARY OF COMPUTER TERMS (cont.)

LPT1, LPT2, LPT3 - Short names for line printers. The names that DOS uses to refer to printers attached to the computer.

Local Area Network - A system of connected microcomputers located within a building or several close buildings.

Menu - Choice of alternative commands available to the user.

Messenger - One of the four configurations of the PC Network.

Micro computer - A small computer system usually used by one person.

Monitor - Display screen on the computer.

Processor - An integrated circuit where the processing of data and instructions is performed.

NETBIOS - Program used for the management of the network communications hardware.

Network - A group of computers linked by cable that share resources.

Network Administrator - Person who manages and coordinates the activities, programs and resources of a network.

Operating System- A program that coordinates the operation of all parts of a computer system.

Path - The list of directory names that defines the location of a file on a directory.

Peripheral - Component of a computer that is not attached to the central processing unit.

Print Queue - The list of jobs waiting to be printed.

Program - A set of instructions for a computer.

Prompt - A request by the computer for you to provide some information or perform an action.

RAM - The memory used for program and data. RAM is lost when the computer is turned off.

Reserve Name - A name that has a fixed meaning to the operating system.

ROM - A portion of the computer's memory in which the programs are permanently recorded.

GLOSSARY OF COMPUTER TERMS (cont.)

Server - A machine that offers its resources to the network. One of the four configurations of the PC Network.

Software - The programs that are used with a computer system.

Spool - A place of temporary storage for data files while they are waiting to be printed.

Storage - Memory in the microcomputer or on a disk.

Topology - The pattern of connections in a computer system.

Word Processing - The automated processing or manipulating of words using specialized applications designed to help compose, revise, print and file.

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